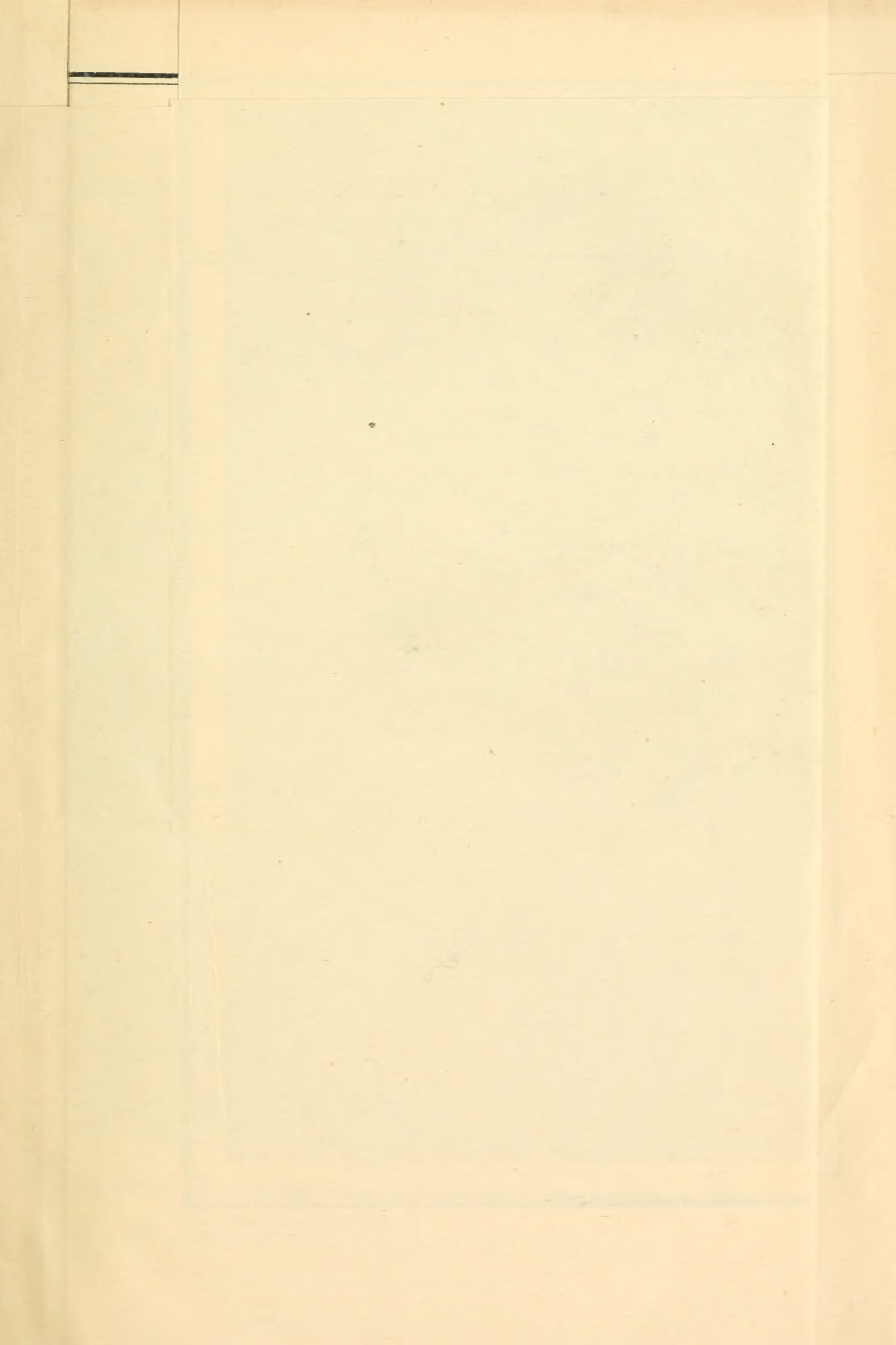




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THE CLIMATES AND BATHS
OF
GREAT BRITAIN



THE
CLIMATES AND BATHS
OF
GREAT BRITAIN

BEING THE
REPORT OF A COMMITTEE
OF THE
ROYAL MEDICAL AND CHIRURGICAL SOCIETY
OF LONDON

C. THEODORE WILLIAMS, M.D., *Chairman*
P. HORTON-SMITH, M.D., *Hon. Secretary*

VOLUME II

*THE CLIMATES OF LONDON AND OF THE CENTRAL AND
NORTHERN PORTIONS OF ENGLAND, TOGETHER WITH THOSE OF
WALES AND OF IRELAND*

Contributors

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PREFACE

THE issue of the second volume of the *Climates and Baths of Great Britain and Ireland* completes the work undertaken by the committee of the Royal Medical and Chirurgical Society in 1889.

The second volume contains reports on the *Climates* of the districts of England and Wales not described in the first volume, viz.: the East Counties and Coast from the Thames to the Tweed, the Midlands, the Lake District and North-West Coast, North and South Wales and Ireland, and every effort has been made to render these reports useful and serviceable to medical practitioners and their patients.

The *Climates* of Scotland have been omitted, as the committee failed to secure the necessary local co-operation.

The subjects have been arranged on the same plan as in Volume I, and in order to secure uniformity and accurate comparison of data, the meteorology of the same series of years has been investigated, viz. 1880–1890.

At the same time the work has been, as much as possible, brought up to date, and the numbers of the population in the towns are taken from the census tables of 1901.

It is much to be regretted that owing to the limitation of space, it has been found necessary to curtail some of the reports, and this especially applies to the valuable material collected by Dr. William Ewart concerning the climate of the London suburbs, and to the mass of information relating to the history and resources of Ireland by Sir John Moore.

The resignation by Dr. Ord of the chairmanship on his retirement from London was a great loss to the committee, as besides Dr. Ord's important contributions to the first volume, which was

edited by Dr. Garrod and himself, he took a leading part in organizing the work of the committee. The meetings were held at his house, and most of the members will recall with pleasure the graceful hospitality with which he received them, and the kindly but discriminating criticism he bestowed on their reports. Dr. Theodore Williams was appointed to succeed Dr. Ord as chairman.

Another loss was the death of Dr. Leech of Manchester, who attended several meetings of the committee and contributed the excellent report on North Wales to the present volume.

Dr. Archibald Garrod, after successfully accomplishing the work of bringing out the first volume, and also largely contributing to its contents, resigned the secretaryship and has been worthily succeeded by Dr. P. Horton-Smith, who has brought to the task such an amount of energy, industry, and tact, that the publication, which seemed likely to be indefinitely postponed, has been completed in a comparatively short period. Dr. Horton-Smith has also contributed the report on the Midlands, and has, by his skilful mastery of detail, smoothed the path of several of the contributors.

The committee have to thank many friends for valuable assistance, and in addition to those mentioned in separate reports they wish to record their obligations to Mr. William Marriott, the assistant secretary of the Royal Meteorological Society, for much kindly help.

In conclusion they would express a hope that the varied information collected in these volumes may prove of use, not only to Medical men and Officers of Health, but also to Civil Engineers, Agriculturists, Horticulturists, and especially to those municipal bodies and County and District Councils, who are largely interested in the health of the community.

C. THEODORE WILLIAMS (*Chairman*).

LIST OF THE COMMITTEE
AS AT PRESENT CONSTITUTED

C. THEODORE WILLIAMS, M.D., *Chairman.*

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ROBERT L. BOWLES, M.D.

H. L. BROOKSBANK, M.B.

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SIR JOHN WILLIAM MOORE, M.D.

P. HORTON-SMITH, M.D., *Secretary.*

TABLE OF CONTENTS

	PAGE
THE CLIMATE OF--	
LONDON AND MIDDLESEX, BY WM. EWART, M.D., CANTAB., F.R.C.P.	1
THE EAST COAST, BY WILLIAM MURRELL, M.D., F.R.C.P. . .	81
THE MIDLAND COUNTIES, BY P. HORTON-SMITH, M.D., F.R.C.P.	119
LANCASHIRE, BY ROBERT MAGUIRE, M.D., F.R.C.P.. . . .	187
THE LAKE DISTRICT, BY H. L. BROOKSBANK, B.A., M.B., B.C., CANTAB.	195
NORTHUMBERLAND, DURHAM AND YORKSHIRE, BY W. S. LAZARUS-BARLOW, M.D., F.R.C.P.	230
NORTH WALES, BY D. J. LEECH, M.D., D.SC., F.R.C.P. . .	286
SOUTH WALES, BY C. THEODORE WILLIAMS, M.D., F.R.C.P.; LATE PRESIDENT OF THE ROYAL METEOROLOGICAL SOCIETY	329
IRELAND, BY SIR JOHN W. MOORE, M.D., D.P.H., UNIV. DUBLIN; F.R.MET.SOC.; LATE PRESIDENT OF THE ROYAL COLLEGE OF PHYSICIANS OF IRELAND	381
MINERAL SPRINGS OF IRELAND, BY NORMAN MOORE, M.D., F.R.C.P.	578
INDEX	587

LIST OF MAPS

1. MAP OF ENGLAND AND WALES, SHOWING ELEVATIONS	<i>Engraving</i>	
2. MAP OF GREATER LONDON, SHOWING ALSO THE BOUNDARIES OF THE COUNTY AND CITY OF LONDON	<i>Two p.</i>	5
3. MAP SHOWING THE AREAS OF THE METROPOLITAN BOROUGHES	„	51
4. RAINFALL MAP OF THE BRITISH ISLES	„	128
5. MAP OF THE ISOTHERMALS, SHOWING THE MEAN TEM- PERATURE OF THE BRITISH ISLES IN JANUARY AND JULY	„	335
6. MAP SHOWING THE RAINFALL ON THE SOUTH WALES COAST	„	337
7. MAP OF IRELAND, SHOWING ELEVATIONS	„	628

The following are the Circular Letters which were sent to the Medical Men practising at the various health resorts and bath-places:—

1. LETTER ASKING FOR INFORMATION REGARDING A CLIMATIC RESORT.

DEAR SIR,

A Committee has been appointed by the Royal Medical and Chirurgical Society to investigate the Climatology and Balneology of Great Britain and Ireland. In pursuance of this object the Committee ventures to ask the aid of the medical men practising at the various health resorts (and at other places to which interest attaches in this relation), who alone possess the experience necessary for the formation of a just estimate of the therapeutic value of their climates.

Information is desired upon the following points with regard to

- I. The prevalence among the permanent residents, or the inter-currence in visitors, of the following diseases; and the influence of the climate upon patients sent there for the treatment of any of them.

- A. *Anæmia and Debility.*

- B. *Scrophula and Tuberculous Diseases, except Phthisis Pulmonalis.*

- C. *Diseases of the Respiratory Organs.*

- Phthisis (with special reference to hæmoptysis).

- Bronchitis and Catarrh.

- Pneumonia.

- Pleurisy.

- Asthma.

D. *Renal Diseases.*

Acute Renal Dropsy.

Chronic Albuminuria (state whether presumably associated with granular kidney).

Calculus and Gravel.

E. *Rheumatism, Rheumatoid Arthritis, and Neuralgia.*F. *Diseases of the Skin, particularly Eczema.*G. *Endemic Diseases.*

Malarial Affections.

Typhoid Fever.

Diarrhœa.

Scarlet Fever.

Diphtheria.

Endemic Sore Throat.

II. The common causes of death, and frequency of old age, among the permanent residents.

III. The system of drainage adopted.

IV. The water supply.

The following Outline for Climatological Reports was sent with the above letter :—

GENERAL PART.

1. Definition of District.

2. General Physical Characters of District.

*Protection from winds,**Exposure, &c.*

3. Brief Notice of Geological Formation, and Soil : with special reference to Dryness and Humidity.

Configuration of surface, in relation to natural drainage.
*Elevations.**Protection from wind, rain, and fog.*4. Trees, as affording Protection, and Modifying Climate.
Vegetation, as evidence of character of Climate.

5. Effects of Ocean Currents upon Climate of District.

6. General Description of Climate and Meteorology of District,
with analysis of, and deductions from, the Tables.*Temperature of air, humidity, &c.**Prevailing winds, sunshine.**Rainfall, fog.*

7. Characters of the Climate in different seasons.

SPECIAL PART.

8. Detailed consideration of the climatic characters, and special features of limited districts and resorts, with some mention of—

Drainage.

Water supply.

9. Prevalence of diseases, as given in circular letter.
10. Therapeutic effects of the Climate, or Climates, with indications as to their uses in particular Diseases.
-

2. LETTER ASKING FOR INFORMATION CONCERNING A BATH-PLACE.

DEAR SIR,

A Committee has been appointed by the Royal Medical and Chirurgical Society, to investigate the Climatology and Balneology of Great Britain and Ireland, and it has been decided that a letter shall be sent to medical men practising at the various Bath-places, asking them to be kind enough to give information upon certain points relating to the characters of the mineral waters, the methods of their use, and their therapeutic properties.

The Committee will esteem it a great favour if you will kindly give the benefit of your experience upon any of the following points concerning the waters of.....

- I. *What are the morbid conditions which have, in your experience, been treated with advantage by—*
 - A. *The internal use of the waters.*
 - B. *Their external use.*
 - C. *Their combined internal and external use.*
 - D. *The use of the waters in conjunction with other forms of treatment—e. g., by drugs, massage, and other special methods.*

The subjoined list will indicate to you, in a general way, the affections in respect of which information is specially sought, but the Committee will be grateful if you will furnish any statement which you could make about affections not obviously included in the list.

Gout and Gouty Affections.

Osteo-Arthritis or Rheumatic Gout.

Rheumatism.

Muscular Rheumatism.

Gonorrhœal Arthritis (or Gonorrhœal Rheumatism).

Sciatica.

Syphilis.

Tubercular and Scrofulous Affections.

Anæmia.

Diseases of the Skin, with special reference to Eczema and Psoriasis.

Diabetes and Glycosuria.

Urinary and Renal Diseases.

Diseases of the Respiratory System.

Diseases of the Circulatory System.

Diseases of the Digestive System (including the Liver).

Diseases of the Nervous System.

Diseases of Women.

Results of Injury.

- II. *What are the various ways in which the waters are employed, and what forms of treatment, if any, are had recourse to, apart from, or in addition to, the use of the Mineral Waters?*
- III. *In what conditions do you consider the use of the waters to be contra-indicated—*
- A. *By the character of the disease proposed to be treated?*
- B. *By the state of the patient apart from the disease proposed to be treated?*
- IV. *At what time of year should the treatment be undergone?*

NOTES ON THE METEOROLOGICAL DATA INCLUDED IN THE TABLES PUBLISHED IN THE REPORT

BY E. J. HORSTMAN

SENIOR COMPUTER TO THE ROYAL METEOROLOGICAL SOCIETY

The *Mean Pressure of Atmosphere in Month* is the mean of the daily readings of the barometer at 9 A.M. and 9 P.M., corrected for temperature and reduced to sea-level.

The *Highest Temperature of Air in Month* is the absolute highest of the daily readings recorded by the self-registering maximum thermometer.

The *Lowest Temperature of Air in Month* is the absolute lowest of the daily readings recorded by the self-registering minimum thermometer.

The *Monthly Range of Temperature* is the difference between the absolute highest and lowest temperatures registered in each month.

The *Mean of Highest Temperatures of Air in Month* is the average of the daily maximum temperatures.

The *Mean of Lowest Temperatures of Air in Month* is the average of the daily minimum temperatures.

The *Mean Daily Range of Temperature in Month* is the difference between the average of the daily maximum and the average of the daily minimum temperatures.

The *Mean Temperature of the Air in Month* is obtained by adding together the average of the daily maximum and the average of the daily minimum temperatures, and dividing their sum by 2.

The *Mean Humidity* is calculated by dividing the elastic force of aqueous vapour, at the temperature of the dew point at 9 A.M. (as determined by

(Glaisher's factors) by the elastic force of aqueous vapour corresponding to the temperature of the air at 9 A.M. (*i. e.* reading of dry bulb thermometer).

The *Amount of Sunshine* is the total of the daily records made by the sunshine recorder.

Wind.—Observations of the *Direction of the Wind* are made twice daily, viz. at 9 A.M. and 9 P.M., and the figures in the tables are the sums of these two observations.

Rain is measured daily at 9 A.M., and the amount entered to preceding day. A fall of .006 inch and above constitutes a *day of rain*.

The *Amount of Cloud* is for 9 A.M., and is estimated according to the scale 0 to 10: 0 representing a cloudless sky, and 10 a completely covered or overcast sky.

REPORT ON THE COUNTIES OF LONDON AND MIDDLESEX¹

By WM. EWART, M.D., CANTAB., F.R.C.P.

INTRODUCTORY REMARKS

THE scope of this Report includes a much larger area than that of the County of London. The extensive surrounding zone, which both territorially and for purposes of administration is made up of portions of Middlesex, of Hertfordshire, of Essex, of Surrey, and of Kent, nevertheless in most other ways belongs to London rather than to the metropolitan counties. Within this "Greater London," as it is called (see map, p. 5), the county of Middlesex is entirely contained. The other metropolitan counties are separately dealt with, and the administrative fragmentation of the region under review needs no further reference in these pages. The vastness of the subject is an inducement to brevity; and limitations of space have unavoidably curtailed the original report in spite of the acknowledged importance of all that influences the health and the life of the greatest agglomeration of human beings in the world.

In earlier times Ludgate Hill and the neighbouring heights, covered by the smaller London of those days, may have been, as suggested by Dr. Norman Moore,² health resorts for the marshy

¹ The writer has pleasure in acknowledging valuable help and much courtesy received from Mr. Shirley F. Murphy, Medical Officer of Health of the Administrative County of London, and the Staff in his department and other departments, and from Mr. Horace B. Woodward, F.R.S., Assistant Director of the Geological Survey, and also the great value of the assistance of Mr. W. Darley Bentley, of the Statistical Department of the London County Council, in finally revising the Report and bringing it up to date.

² The following is Dr. Norman Moore's interesting note on this subject: "London

lands around. A vast population now travels for purer air and health from the city to the suburbs, even to those which were formerly the home of fever. A description of this zone, if it could be made complete and systematic, would be the most useful part of the Report. Brooklyn has been described as the "bedroom of New York." In the case of London the "sleeping and recruiting area" forms a continuous circle. Within it are to be found definite varieties of climate, the choice between which may sometimes mean the preservation of health or its loss. A valuable instalment towards their study, which appeals to those with the responsibility of medical advice, has recently been published by Mr. Horace B. Woodward,¹ F.R.S.; and in noting the altitude and surface geology of most of the important localities, the writer has availed himself of the information therein provided, and has adopted the same nomenclature.

Although we cannot now, as in former times, think of London and its suburbs as health resorts, a consideration of their relative

was perhaps once a sanatorium for malarial cases from Essex. St. Eareconwald, bishop of the East Saxons, was buried early in the seventh century in his cathedral of St. Paul. The litter in which he was carried about when too ill to walk or ride was placed there, and a visit to his tomb has cured many sick East Saxons. It is reasonable to suppose that a stay on the healthy upland of Ludgate Hill, while performing devotions at St. Eareconwald's tomb, was a natural cure for the tertian fevers of the Essex marshes. Later ages came to think that a bit of the litter cut off would cure the ague, and thus no doubt the reputation of the cure and its original therapeutic method became extinct about the same time. Some of it remained in Bede's time. It may have been about A.D. 739 that he wrote: 'Etenim usque hodie feretrum ejus caballarium, quo infirmus vehi solebat, servatum a discipulis ejus, multos febricitantes, vel alio quolibet incommodo fessos, sanare non desistit.' (*Historia Ecclesiastica Gentis Anglorum*, Book IV. Cap. vi.) I may translate Bede's Latin: 'For to this day his horse-litter, in which, when enfeebled, he used to be carried, preserved by his scholars, has not ceased to cure many sick with fever, or worn out with some other trouble.' Pilgrim Street, leading into Ludgate Hill, was the old way from the landing-place near the mouth of the Fleet, to St. Paul's, and to the tomb of St. Eareconwald. When I lived at St. Bartholomew's, I often looked at the name of Pilgrim Street with interest, as the memorial of a time when Ludgate Hill and St. Paul's Churchyard were a health resort, about which anæmic East Saxons might be seen walking, enjoying the dry soil and fresh air, paying their respects to St. Eareconwald, and refreshed more and more every day by the breezes from the hills of Hampstead and Highgate."

¹ *Soils and Subsoils from a Sanitary point of view, with especial reference to London and its neighbourhood*, by Horace B. Woodward, F.R.S. (*Memoirs of the Geological Survey—England and Wales*.) Published by order of the Lords Commissioners of Her Majesty's Treasury. Eyre and Spottiswoode, London, 1897.

fitness for habitation has become a question of the day. Their relatively small area accommodates considerably more than one-eighth of the total population of these islands. The estimated population of *Greater London*,¹ which is co-extensive with the Metropolitan and City Police Districts, was 6,528,434 in the middle of the year 1899, including 4,546,752 in Inner or Registration London, and 1,981,682 in the Outer Ring. How so large a community contrives to exist under its unique conditions is a marvel; but there is also a practical aspect to the study of London. Its medical history is that of a small world, and it illustrates lessons of disease and of hygiene nowhere so easily read, which our limited space can only admit in outline.

So far as possible, the general scheme adopted in the description of other counties has been adhered to both in connection with the Rural Suburban Zone and with the metropolitan area itself. But in London the physical features do not occupy the foreground, and the natural climate differs little from that of the neighbouring country. Its artificial characters are the most distinctive and important. Everything is artificial, from the "made ground" upon which it is built, to its water-courses, some of which are turned away from their natural beds, and to the composition of its air, so much altered by smoke-laden fogs and mists, that the meteorology of London is one *sui generis*.

Again, the problem how to maintain health and how to exclude disease, in spite of the excessive density of the population, has been worked out by gradual adaptation, and its present solution is in itself a wonderful achievement. Hygiene, water-supply, drainage, ventilation, sanitation in building, and much else of equal importance, properly fall within the scope of a report on medical climatology.

Lastly, the comparative study of disease, not only in its contrast between London and the rest of England, but in its more instructive contrasts between different districts in the metropolis, cannot be carried out without some previous reference to the subdivision of the county of London into parishes and sanitary areas, and to the peculiarities of the several districts.

The same basis of municipal geography is an essential preliminary

¹ Registrar-General's Annual Summary for 1900.

to an inquiry into the management of public health. Climate has to be taken into account; but far more potent agents are the dangerous influences of agglomeration, and the saving regulations of hygiene. Their conflict is carried out with widely-varying results as regards local incidence of disease and of death in different parts of London; and this comparative study necessitates some reference to the boundaries, size, and population of the several sanitary districts. The municipal divisions (see map, p. 51) are also intimately bound up with recent progress and improvements. In a word, a report on the *County of London* would be incomplete unless it were to include, in addition to the heads of report applicable to all counties, those which belong to London *as a town*.

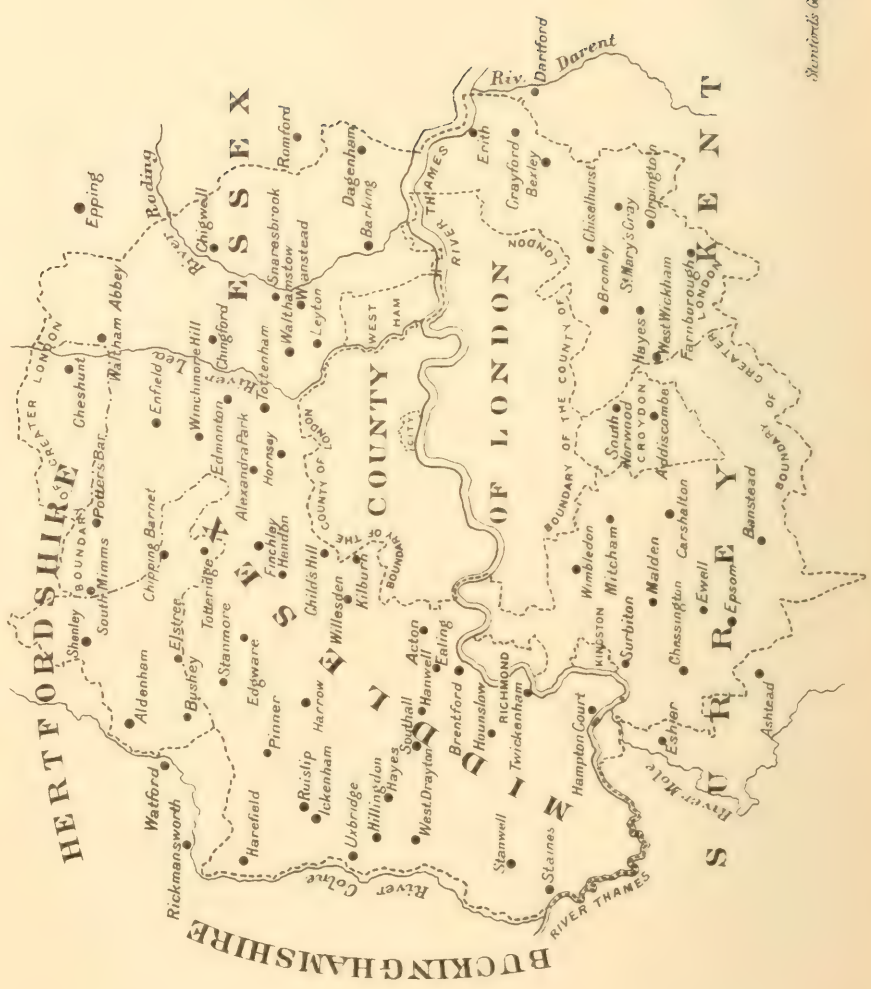
There is neither call nor space for extensive statistics, nor for a complete graphic description of the metropolis. Descriptive detail is needed in two directions only: in connection with public health and hygiene as they may be studied in the different districts (statistics are here indispensable), and in connection with the health value of the suburban areas, as the selection of a suburban residence is the practical object for which information such as a report of this kind might contain is most often sought.

Much has been unavoidably omitted for want of space from the Report which had been written on the lines sketched out. In its simplified form it is now made up of the following sections:—

- i. The general physical and geological features, and the general climatology and meteorology of Greater London, including Middlesex.
- ii. The local meteorology of London, with special reference to fogs and atmospheric impurities.
- iii. The water supply and drainage.
- iv. The mortality and death-rate.
- v. The comparative health value of various parts of London for residence.
- vi. An index of local surface geologies and altitudes within Greater London.

MAP OF GREATER LONDON, SHOWING ALSO THE BOUNDARIES OF THE COUNTY AND CITY OF LONDON.

St Albans



Standard's Map, Edited by London.

I.

THE GENERAL PHYSICAL AND GEOLOGICAL FEATURES AND THE GENERAL CLIMATOLOGY AND METEOROLOGY OF GREATER LONDON, INCLUDING MIDDLESEX.

Greater London, as defined at the General Register Office,¹ includes "all parishes wholly comprised within a circle of fifteen miles from Charing Cross, and all other parishes of which any part is included within a circle of twelve miles radius from the same centre." It takes in the whole area between Barnet on the north, Barking on the east, Croydon on the south, and Staines and Uxbridge on the west. Of this aggregate of 693 square miles only 118 are within the **County of London**. These two areas are shown in the accompanying map.

The "Outer Circle" of Greater London, made up of fragments from the four metropolitan counties, Middlesex, Surrey, Kent and Essex, and a small portion of Hertfordshire, will be best dealt with as a whole, though a distinction may be made between its suburban and its outer suburban zone.

The Suburban and the Outer Suburban Zones are distinct from London in many ways, especially in their more modern construction, and in their possessing a natural surface soil instead of the made-up ground of the densely overbuilt area which belonged to the ancient townships of London, Westminster, etc. The outer zone is now the only truly rural district within Greater London, and for reasons of public health it will claim attention.

¹ Quoted from *Soils and Subsoils*, by Horace B. Woodward, *loc. cit.* p. 1.

THE GENERAL GEOLOGY OF GREATER LONDON.
THE "LONDON BASIN."

The Geology of the London Basin.—The Surface Geology of the district will be rendered more intelligible by a brief reference to the deeper strata.

The so-called "London Basin" which stretches far beyond London, even under the German Ocean, is formed by the cupping of a deep layer of 650 feet of chalk, which extends continuously under the more superficial deposits. In its thickness, however, there occurs in the district of Woolwich a crack with displaced edges, known as a "fault"; and this leads to the tilting up of sections of the overlying strata, which one after the other reach the surface with their fractured edges.

The hollow of the chalk cup has a maximum depth of about 350 feet, and at the depth of 1000 feet it rests upon the Upper Green Sand which is separated from the Lower Green Sand by a layer of Gault (Clay) below which the Weald Clay and the Hastings Beds of Sand, Sandstone and Clay complete the series of the *secondary* formation.

Above the chalk the *tertiary* series presents in ascending order the Thanet Sands, the Woolwich and Reading Beds of Clay, Sand and Gravel, the Blackheath Beds of Gravel, the London Clay, all of which are known collectively as the Lower London tertiaries, and the Bagshot Sands (upper, lower, and middle—the middle layer also containing Loam and Clay).

Lastly, the *quaternary* series comprises, in ascending order, the Glacial Drifts of Boulder-Clay, of Loam, of Gravel, and Sand, the deposit of Clay-with-Flints, the River Gravel and Sand, and the patchy deposit of Brick-Earth (Loam) and of Alluvium (Silt, Marl, Clay, and Peat), and finally the *natural soil* or mould, and the *made-ground*.

Most of the deposits enumerated, including the chalk, approach the surface, in different localities; but the older secondary strata do not enter into the formation of the sub-soil of the London district.

Great variety within a limited area is encountered only in the Blackheath and Woolwich district. In connection with the fault

which has been mentioned, and with the disappearance by denudation of the London Clay (except at Shooter's Hill) the chalk, as well as the sandy and gravelly layers above it, become superficial in narrow concentric belts.

Northwards from the Surrey Downs the thin edge of the London Clay deposit rapidly acquires thickness in its chalky basin. But along the bed of the Thames it is itself covered by a layer of gravel and sand which bears scattered deposits of Loam (Brick-Earth), of Alluvium, and of alluvial deposits, including Peat.

North of London, and in north Middlesex, patches of Gravel and Sand occur—some being elevated recent deposits, others the remains of strata of Bagshot Sands which have been worn away.

Rather extensive quaternary deposits of Glacial Drift (Boulder-Clay, Loam, Gravel and Sand) also occur in this region.

The Surface Configuration, Hydrography and Altitude of Greater London.—In respect of Surface Configuration, Greater London north of the Thames, which includes the whole of Middlesex, is singled out by the peculiarity of its watershed, almost as a unit. It is completely surrounded by rivers so as to be nearly converted into an inland island and to be practically cut off from the orological system of adjoining areas. In the upper part of their course the Verulam or Colne, before forming the western county boundary, and the Lea before helping to form the eastern boundary, come within a short distance of each other, the Colne at St. Albans and the Lea at Hatfield. Indeed the town of Hatfield alone intervenes between the Lea and the London-Colney branch of the Colne which springs from the foot of Roe Hyde Downs, at Roe Green, the two valleys following at this altitude a direction almost at right angles to each other. Subsequently they both adopt a southerly direction from Rickmansworth and Ware respectively, and almost close in, north of London, the circle of rivers which is completed by the river Thames in the south.

Altitude.—A relief map, such as that on view at the Museum of Geology, shows at a glance the prevailing features. The altitude in general is unimportant, and slight elevations occur either quite isolated or separated by short valleys, rather than in any continuous ridge such as the neighbouring ridge of Totteridge in Hertfordshire.

On the north side of the river a rise takes place very gradually from a low alluvial bank up to moderate elevations, though minor undulations occur on the way. The culminant area is that of the Highgate and Hampstead group. To this central height the gradients work up slowly from the Thames due south of Chelsea steadily to Hampstead, but much less gradually from the other sides. The long axis of this group is parallel rather than vertical to the course of the Thames.

The south bank is exceedingly flat all the way down the stream as far as Greenwich, where it acquires a slight elevation in connection with the geological fault,—but behind the riverside flats the surface rises much more quickly, and owing to the intervening valleys there is marked variety of surface, without however any approach to abruptness. The moderately high plateau and ridges which occupy the immediate hinterland take on the main a direction from north to south, which is that of the small tributaries of the Thames. Two of them, however, diverge towards the Thames in the shape of the letter V from a common culmination at Upper Norwood; Herne Hill lies in front of this angle.

On the contrary, eastwards of the Ravensbourne the heights run parallel to the river, and free undulations are seen as we look to the south into Kent from Blackheath over the Eltham district.

Extensive *riverside flats* range east and west of the district of St. Paul's and Holborn, where the slightly raised bank seems to have acted as an attraction to the earlier settlers. The width of this low-lying tract varies much. Its chief expansions are, in the west, in the Battersea and Fulham region; in the south at Lambeth; and to the east in the Essex district of Plaistow. It does not adapt itself to each bend of the Thames, but on the whole forms a fairly even tract with oblique and slightly northerly direction from Mortlake towards Barking.

The highest altitudes in Greater London are to be found at the extremity of its boundary both on the north and south of the Thames. For instance, we have on the north, Stanmore, Bentley Priory, Elstree Ridge, Bentley Heath and Northam all over 370 feet, and on the south, Banstead, Woodmanstone, Coulsdon, Warlingham, Farley Downs and Farnborough, the majority of which have an altitude of over 500 feet.

THE GENERAL CLIMATOLOGY AND METEOROLOGY OF GREATER LONDON.

In dealing with the *natural climate* of London it may be pointed out:—

(1) That London belongs to the east coast district, though relatively distant from the sea, the Essex flats offering no obstruction to the east winds that blow straight up the estuary of the Thames, and that a fairly well-marked easterly type of climate thus prevails; (2) that the width and shallowness of the valley and the tidal character of the river are conducive to ventilation in general, and particularly to that of the east end; and (3) that the Thames valley on the other side of London is open to the south-west. It thus happens that the south-westerly and Atlantic influence, though it has to travel farther and over relatively higher ground, bears upon it with as much directness as could be expected at so great a distance from the south coast.

Thus the average London climate is a mixed and tempered product of both influences, not being exposed to the unmitigated force of either of them; and its characteristic oscillations between relaxing or “muggy,” and dry or bracing weather are easily explained.

The openness of the valley and the absence of great neighbouring heights also keep it free from excessive cloud and rainfall.

The permeability of the gravel and sand which occupy the lower part of the district, whilst the clay, some of which is also permeable, occurs farther away from the river where the slope favours natural drainage, is also an important natural feature.

The *artificial* modifying influences, which are all the outcome of the structural development and expansion of a town, may be traced in the surface and configuration, in the atmosphere, the hydrology, the water-supply and the drainage of the metropolis. Some of their effects are perceptible (1) in the temperature, (2) the moisture, (3) the altered chemical composition of the air of London, (4) in its mechanical contaminations, (5) in its lessened transparency, and (6) in the dispersion of the natural draughts. Not improbably they also influence the local rainfall and cloud, so far as these may be affected by a modified

temperature, humidity and ventilation. Some of these points are brought out in the appended Tables specially prepared for this Report:—

MONTHLY MEANS FOR TEN YEARS (1880-89), OR AS MUCH OF THAT PERIOD AS COULD BE OBTAINED.

Station, OLD STREET, E.C. (1883-9). Height above Mean Sea-level, 69 feet.

The REV. A. P. HOCKIN, Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.)	Amount of Sunshine.	Mean Cloud (9 a.m.)	RAIN.	
	1 Highest.	1 Lowest.	Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.					Days it fell.	Inches.
January . . .	55.7	21.6	34.1	43.7	35.4	8.3	39.6	87	hrs. ² 9	9.2	17	1.81
February . . .	57.0	21.3	35.7	44.8	35.9	8.9	40.3	84	22	8.8	15	1.70
March . . .	67.1	23.1	44.0	46.8	35.5	11.3	41.1	81	57	8.5	14	1.56
April . . .	72.0	26.4	45.6	54.2	40.3	13.9	47.3	74	105	8.4	15	1.78
May . . .	80.7	32.1	48.6	61.7	46.6	15.1	54.1	70	164	8.2	16	2.30
June . . .	86.9	41.3	45.6	69.1	52.6	16.5	60.8	69	167	7.7	10	1.81
July . . .	87.4	43.8	43.6	71.2	55.9	15.3	63.6	70	166	7.9	15	2.51
August . . .	90.0	45.1	44.9	71.0	55.4	15.6	63.2	72	151	7.6	12	1.72
September . . .	84.2	38.2	46.0	65.2	52.2	13.0	58.7	77	91	8.2	16	2.43
October . . .	78.0	31.6	46.4	55.6	44.7	10.9	50.1	82	57	8.4	17	2.07
November . . .	69.5	22.9	46.6	49.3	41.1	8.2	45.2	86	20	9.2	17	2.78
December . . .	57.7	24.9	32.8	44.6	36.4	8.2	40.5	86	4	9.3	15	1.83

MEANS FOR TEN YEARS (1880-89), OR AS MUCH OF THAT PERIOD AS COULD BE OBTAINED—QUARTERLY AND YEARLY.

Station, OLD STREET, E.C. (1883-9). Height above Mean Sea-level, 69 feet.

The REV. A. P. HOCKIN, Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.						Mean Temperature of Air.	Mean Relative Humidity (9 a.m.)	Amount of Sunshine.	Mean Cloud (9 a.m.)	RAIN.	
	1 Highest.	1 Lowest.	Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.					Days it fell.	Inches.
Jan.—Mar. . .	67.1	21.3	45.8	45.1	35.6	9.5	40.3	84	hrs. ² 88	8.8	46	5.07
April—June . .	83.9	29.4	54.5	61.7	46.5	15.2	54.1	71	436	8.1	41	5.89
July—Sept. . .	90.0	38.2	51.8	69.1	54.5	14.6	61.8	73	408	7.9	43	6.66
Oct.—Dec. . .	78.0	22.9	55.1	49.8	40.7	9.1	45.3	85	81	9.0	49	6.68
Whole year . .	90.0	21.3	68.7	56.4	44.3	12.1	50.4	78	1013	8.3	179	24.99

¹ Highest and Lowest = Absolute Highest and Lowest in Period.

² The sunshine observations are made at Bunhill Row, E.C., and are for the years 1881-9.

MONTHLY MEANS FOR TEN YEARS (1880-89), OR AS MUCH OF THAT PERIOD AS COULD BE OBTAINED.

Station, REGENT'S PARK (1881-9). Height above Mean Sea-level, 125 feet.

W. SOWERBY, Esq., F.R.Met.Soc., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air in Month.	Mean Relative Humidity (a.m.)	Amount of Sunshine.	RAIN.	
	1 Highest.	1 Lowest.	Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	55.3	9.8	45.5	42.4	33.3	9.1	37.8	72	16	14	1.82
February	56.7	15.5	41.2	44.4	34.5	9.9	39.5	72	38	13	1.85
March	68.3	20.0	48.3	48.0	34.6	13.4	41.3	73	48	12	1.71
April	71.3	25.0	46.3	54.4	38.9	15.5	46.6	75	86	13	1.73
May	80.3	27.5	52.8	62.0	44.8	17.2	53.4	73	144	14	2.13
June	85.3	37.8	47.5	68.3	50.4	17.9	59.3	73	172	11	1.97
July	93.5	42.3	51.2	71.5	54.0	17.5	62.7	72	152	14	2.50
August	91.8	41.1	50.7	70.2	52.9	17.3	61.5	75	160	13	2.11
September	84.8	32.5	52.3	64.4	49.5	14.9	57.0	73	96	14	2.43
October	77.3	26.0	51.3	55.0	42.3	12.7	48.6	76	68	15	2.76
November	63.0	21.5	41.5	49.4	39.4	10.0	44.4	77	22	16	2.59
December	57.8	19.0	38.8	43.9	34.6	9.3	39.3	79	13	15	1.91

MEANS FOR TEN YEARS (1880-89), OR AS MUCH OF THAT PERIOD AS COULD BE OBTAINED—QUARTERLY AND YEARLY.

Station, REGENT'S PARK (1881-9). Height above Mean Sea-level, 125 feet.

W. SOWERBY, Esq., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.						Mean Temperature of Air.	Mean Relative Humidity (a.m.)	Amount of Sunshine.	RAIN.	
	1 Highest.	1 Lowest.	Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	68.3	9.8	58.5	44.9	34.1	10.8	39.5	86	102	39	5.38
April—June	85.3	25.0	60.3	61.6	44.7	16.9	53.1	74	402	38	5.83
July—Sept.	93.5	32.5	61.0	68.7	52.1	16.6	60.4	77	408	41	7.04
Oct.—Dec.	77.3	19.0	58.3	49.4	38.8	10.6	44.1	82	103	46	7.26
Whole year	80.5	9.8	70.7	56.2	42.4	13.8	49.3	81	1015	164	25.61

¹ Highest and Lowest = Absolute Highest and Lowest in Period.² The sunshine observations are for the years 1887-9 only.

MONTHLY MEANS FOR TEN YEARS (1880-89), OR AS MUCH OF THAT PERIOD AS COULD BE OBTAINED.

Station, FINCHLEY, MIDDLESEX (1881-4). Height above Mean Sea-level, 275 feet.

H. C. STEPHENS, ESQ., F.R.Met.Soc., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.						Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	RAIN.	
	Highest.	Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature of Air in Month.			Days it fell.	Inches.
January	54.2	8.4	42.7	32.8	9.9	37.8	91	7.7	14	1.87
February	54.7	23.0	45.1	34.7	10.4	39.9	91	7.4	18	2.47
March	62.1	19.7	48.8	35.9	12.9	41.3	74	5.9	13	1.56
April	66.8	27.1	53.9	37.2	16.7	45.6	77	6.3	12	1.92
May	77.2	29.0	62.0	42.7	19.3	52.3	75	5.2	12	1.39
June	82.8	36.5	65.5	47.9	17.6	56.7	77	6.2	14	2.30
July	89.7	38.1	69.5	51.7	17.8	60.6	77	5.6	16	2.31
August	89.7	36.9	69.2	51.2	18.0	60.2	80	5.9	14	2.07
September	79.2	33.4	65.5	48.2	17.3	56.0	87	6.7	15	2.52
October	71.7	26.1	54.6	40.9	13.7	47.8	87	6.5	18	2.96
November	62.4	20.3	49.0	37.1	11.9	43.0	91	7.0	19	2.74
December	55.8	15.2	43.4	34.0	9.4	38.7	91	7.0	20	2.49

MEANS FOR TEN YEARS (1880-89), OR AS MUCH OF THAT PERIOD AS COULD BE OBTAINED—QUARTERLY AND YEARLY.

Station, FINCHLEY, MIDDLESEX (1881-4). Height above Mean Sea-level, 275 feet.

H. C. STEPHENS, ESQ., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.						Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	RAIN.	
	Highest.	Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature of Air.			Days it fell.	Inches.
Jan.—March	66.1	8.4	45.5	33.8	11.7	39.7	89	7.1	47	5.84
April—June	82.8	27.1	60.5	42.6	17.9	51.5	77	5.9	38	5.31
July—Sept.	89.7	33.4	67.5	50.4	17.1	58.9	82	6.1	45	6.90
Oct.—Dec.	71.7	15.2	49.0	37.3	11.7	43.2	90	6.8	57	8.13
Whole year	89.7	8.4	55.6	41.0	14.5	48.3	85	6.5	187	26.18

¹ Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR TEN YEARS (1880-89), OR AS MUCH OF THAT PERIOD AS COULD BE OBTAINED.

Station, ISLEWORTH, MIDDLESEX (1880-5). Height above Mean Sea-level, 68 feet.

MISS E. A. ORMEROD, F.R.Met.Soc., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	54.9	4.6	42.3	32.2	10.1	37.3	89	7.7	13	1.55
February	58.2	23.7	47.8	36.1	11.7	42.0	89	7.6	16	2.39
March	68.1	21.2	50.0	34.0	16.0	42.0	81	6.1	9	1.27
April	72.3	25.1	56.1	38.9	17.2	47.5	78	7.1	13	1.75
May	84.5	30.2	63.0	43.2	19.8	53.1	68	6.1	11	1.27
June	83.6	34.3	68.1	49.5	18.6	58.8	70	7.3	13	1.81
July	93.0	39.2	72.0	52.9	19.1	62.4	71	7.0	17	2.00
August	91.2	39.0	71.1	52.1	19.0	61.6	74	6.9	12	1.61
September	87.7	30.0	66.2	49.0	17.2	57.6	82	7.1	16	3.00
October	70.1	25.0	55.4	41.2	14.2	48.3	87	6.9	16	3.35
November	64.0	22.3	50.0	37.5	12.5	43.7	89	6.8	17	2.34
December	57.0	20.3	44.0	35.0	9.0	40.0	91	7.7	18	1.96

MEANS FOR TEN YEARS (1880-89), OR AS MUCH OF THAT PERIOD AS COULD BE OBTAINED—QUARTERLY AND YEARLY.

Station, ISLEWORTH, MIDDLESEX (1880-5). Height above Mean Sea-level, 68 feet.

MISS E. A. ORMEROD, F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.					Mean Temperature of Air.	Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.)	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	68.1	4.6	47.0	34.4	12.6	40.7	86	7.1	38	5.21
April—June	84.5	25.1	62.4	43.9	18.5	53.1	70	6.8	37	4.83
July—Sept.	93.0	30.0	69.8	51.3	18.5	60.5	76	7.0	45	6.70
Oct.—Dec.	70.1	20.3	50.1	37.9	12.2	44.0	89	7.1	51	7.65
Whole year	93.0	4.6	57.3	41.9	15.4	49.6	80	7.0	171	24.39

1 Highest and Lowest=Absolute Highest and Lowest in Period.

The Meteorological Data.—Some previous remarks on the general meteorology of Surrey,¹ which refer specially to the Thames valley, are generally applicable here. A relative high mean temperature (at 9 a.m.) for the whole year; a moderate mean minimum temperature; an average amount of sunshine, cloud and mist; a very moderate rainfall and humidity; moderate winds, chiefly from the south-west, frequently from the west, slightly less frequently from the south, and lastly, less frequently and with even prevalence from the east and from the north—such are in brief the leading climatic features, and they apply with fair accuracy to the rural parts of Middlesex where the climate is not artificially modified (see Tables for Isleworth and Finchley, pp. 12, 13).

Of great interest is a comparison of the data gathered in the town itself with those recorded in the surrounding country. Unfortunately records are available only from one strictly urban station, that of Old Street, for Regent's Park and Greenwich may both be regarded as free from some of the town influences.

A general idea may be gained, in spite of the want of uniformity in the periods of observation, by comparing the data for the whole year for Old Street (see p. 10) with those from the neighbouring Middlesex stations on the one hand and with the extreme values wheresoever obtained within the British Isles, as supplied by Mr. Bayard's tables.² For the period specified in the table for Old Street the mean of the highest temperatures was 56·4, (Dublin (54·8). Maximum at Portsmouth (57), minimum at Buxton (51·6)).

The mean of the lowest temperatures was 44·3, (Dublin (43·9). Maximum at Guernsey (49·9), minimum at Buxton (37·7)).

The mean temperature of the air was 50·4, (Dublin (49·3). Maximum at Ilfracombe and Guernsey (51·2), minimum at Buxton and Cheadle (45·4)).

The mean relative humidity at 9 a.m. was 78, (Dublin (81). Minimum at Llandudno (79). Maximum at Belper, Cheadle, and Macclesfield (86°)).

The mean cloud at 9 a.m. was 8·5, (Dublin (6·5). Minimum at Weymouth (5·4). Maximum at Seathwaite (7·7)).

The number of days on which rain fell was 164, (Dublin and

¹ *Climates and Baths of Great Britain and Ireland*, vol. i. p. 285, *et seq.*

² *Quarterly Journal of the Royal Meteorological Society*, vol. xviii., No. 84, October 1892.

Buxton (196). Maximum at Londonderry (240), minimum at Bude (150)).

The registered inches of rain were 25·51: (Dublin (26·77). Maxima, Killarney (57·10), Buxton (49·31), Seathwaite (129·04), minimum Lowestoft (24·16)).

Regent's Park is the only London station included among the fifty-two stations reported upon by Mr. Francis Campbell Bayard, F.R.Met.Soc. in his paper on *English Climatology*, 1881—1890, read before the Royal Meteorological Society in 1892. The following table (p. 16) referring to it may with advantage be compared with the meteorological observations at Norwood, Croydon, and Beddington, tabulated on page 287 in the first volume of this Report. It will be seen that at Regent's Park the mean temperature at 9 a.m. (48·9) is frequently less than that at Norwood, and higher than those of Croydon and Beddington. The mean minimum temperature (42·4) is higher than at the other stations (42·1, 41·8, 40·7 in the order stated). The mean maximum temperature (56·1) is almost identical, except with that of Croydon (55·7). The mean temperature (49·2) is identical with that of Norwood and higher than the other two (48·7, 48·3). The relative humidity at 9 a.m. (81 p. c.) is identical with that of Beddington (80 at the other two stations). The amount of cloud at 9 a.m. (6·3) is less than at the others (6·9, 7·4, 6·9). The mean rainfall (25·17) is slightly in excess compared with the other stations (23·83, 24·80, 23·61). The number of rainy days (165) is almost the same (173, 172, 164).

A comparison of the records from Old Street and from Regent's Park with those from the Middlesex stations brings out those differences which would arise from the artificial factors of a town climate, but in a more marked degree at Old Street than at Regent's Park. In particular the extremes of temperature, and especially the minimum temperature, are not so great. The range of the mean daily temperature is much less extensive. The mean temperature is slightly higher. The humidity is decidedly lower, and here we note the marked difference between Old Street (78°) and Regent's Park (81). The rainfall is the same, or rather less.¹

¹ For further details concerning the climatology of London see pp. 129—131.

METEOROLOGICAL OBSERVATIONS TAKEN AT REGENT'S PARK, TABULATED BY FRANCIS CAMPBELL BAYARD, F.R.Met.Soc.,
 IN A PAPER ON ENGLISH CLIMATOLOGY, 1881-1890,
Read before the Royal Meteorological Society, June 15, 1892.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1. Mean temperature at 9 a.m., 1881-90	37.9	38.5	40.2	46.3	51.1	59.1	62.5	61.9	56.6	47.8	43.9	38.1	48.9
2. Mean Minimum Temperature 1881-90	33.8	31.1	31.8	38.9	44.9	50.5	53.8	52.9	49.7	42.3	39.2	33.7	42.4
3. Mean Maximum Temperature 1881-90	42.9	41.1	48.1	54.3	62.1	68.1	71.0	70.9	61.9	55.2	49.2	42.9	56.1
4. Mean Temperature 1881-90	38.1	39.3	41.4	46.6	53.5	59.3	62.1	61.1	57.3	48.7	44.3	38.3	49.2
5. Mean Relative Humidity at 9 a.m., 1881-90	89	87	83	76	71	73	73	76	82	86	88	87	81
6. Mean Amount of Cloud at 9 a.m., 1881-90	7.4	7.0	6.6	6.2	5.5	5.9	5.9	5.5	5.8	6.3	6.9	6.9	6.3
7. Mean Rainfall 1881-90	1.91	1.78	1.73	1.78	2.05	2.05	2.68	2.03	2.25	2.60	2.50	1.81	25.17
8. Number of Rainy Days (0.01 inch and upwards) 1881-90	15	13	12	14	13	12	15	13	12	15	16	15	165

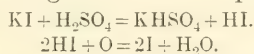
Sunshine in London.¹—The appended table (see p. 18) demonstrates the great loss of sunshine incurred in London, and the local differences occurring at varying distances from its centre. This is a subject intimately connected with the question of fogs, and the latter again is inseparable from the question of humidity. The total number of hours of sunshine registered at Greenwich in each month of the year 1899 is given in the following Table:—

HOURS OF SUNSHINE REGISTERED AT GREENWICH.

January	65·0
February	78·8
March	148·3
April	91·5
May	251·8
June	210·2
July	215·4
August	312·2
September	141·8
October	102·2
November	60·0
December	24·3
Total	1701·5

The Estimation and the Registration of Sunlight have long engaged the attention of meteorologists. Some of the more recent work in that direction is contained in Dr. G. H. Bailey's Report to the Air Analysis Committee at Manchester, and may be briefly reviewed.

The Intensity of Sunlight at different seasons and at different localities was originally studied by Roscoe and Thorpe previous to 1870, and their results have been in general confirmed by Brennan. Part of the work of the Committee was devoted to ascertaining the amount of sunshine and the total light received each day in fifteen different stations in Manchester and its suburbs. This was done by Leeds's method in which the iodine liberated from its potassium salt by dilute sulphuric acid and subsequently decolourized by a standard solution of sodium thiosulphate is a measure of the light during the time of exposure:—



The solution must be neither too weak nor too strong, otherwise the amount of iodine liberated in the dark would be appreciable, or the record of light would be too small.

¹ For further consideration of this subject see pp. 126 and 176.

TOTAL HOURS OF SUNSHINE AND PERCENTAGE¹ OF THE POSSIBLE DURATION OF SUNSHINE FOR EACH MONTH, ON THE MEAN OF FIVE YEARS (1886—1890).

Extracted from *Ten Years' Sunshine in the British Isles, 1881—1890.*²

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
	Hrs. %	Hrs. %	Hrs. %	Hrs. %	Hrs. %	Hrs. %	Hrs. %	Hrs. %	Hrs. %	Hrs. %	Hrs. %	Hrs. %
Bunhill Row Lat. 51° 32'	59 5	133 10	231 13	534 26	777 32	839 31	760 31	799 31	549 29	334 21	95 7	24 2
Westminster Lat. 51° 31'	101 8	127 9	212 13	497 24	758 31	810 33	775 31	827 37	517 29	354 22	126 10	52 4
Greenwich Lat. 51° 28'	141 11	235 17	367 20	618 30	885 37	895 37	825 31	813 38	631 31	407 25	169 13	92 8
Kew Lat. 51° 28'	205 16	249 18	423 23	665 32	904 38	911 39	883 36	941 12	682 63	504 31	216 16	181 15

¹ Jersey is the only station recording, in any month, on the mean of the ten years, an average of even over one-half of its possible duration of sunshine, 72 per cent, was registered there in May, and 55 per cent, in August. The highest figure for any other station was only 18 per cent.

² Published by the Authority of the Meteorological Council. Printed by Eyre and Spottiswoode, London, 1891.

It was verified by experiment that (within certain limits) the amount of iodine liberated was in proportion to the light received, and that, as with silver salts, this solution is much more sensitive to the chemically active (more refrangible) rays of the spectrum. This was done by causing the light to pass through saturated solutions of (*a*) potassium bichromate, of (*b*) ammonium chloride of copper, and of (*c*) chlorophyl (in alcohol) respectively. Thus:—

$\frac{1}{2}$ inch layer of (<i>a</i>)	allowed to pass	10.4 p. c.	$1\frac{1}{2}$ inches layer,	2.1 p. c.
$\frac{1}{2}$ „ „ (<i>b</i>)	..	27.0 p. c.	$1\frac{1}{2}$ „	19.5 p. c.
$\frac{1}{2}$ „ „ (<i>c</i>)	..	4.1 p. c.	$1\frac{1}{2}$ „	1.3 p. c.

Some definite conclusions were arrived at:—(1) November, December, and January are the darkest months—especially within the city; (2) during the winter the average record in densely populated districts is about one-half that of the suburbs (less than one-tenth that of a moderately bright April day); (3) for the actinic effect of sunshine numbers are given in the first Report published in 1891; (4) the smoke and haze of a town atmosphere even in the brightest weather are extremely potent in cutting off the chemically active portion of the light-rays; (5) both in 1891 and 1892 the atmosphere was much the clearest in September and the organic particles and sulphuric acid least then.

The influence of light on micro-organisms is also referred to with mention of the work of Messrs. Downes and Elunt (*Proceedings of the Royal Society*), of Tyndall (*Nature*, 1881, p. 446), and of Duclaux and Arloing (*Comptes Rendus*, 1885), and of Pansini at Naples.

The Relative Dryness of London.—This is perhaps the single artificial modification incidental to the building of a town, of which it may be said that it is entirely satisfactory, particularly in a damp country such as this, and in the vicinity of a large river. The natural climate of London, as tested at adjoining stations otherwise similar, but not subject to the artificial influence in question, is relatively dry, and this is probably due to the permeable character of its soil in the gravel area. But with the exception of the large parks and open spaces, the town as a whole has undergone for years, and particularly during the last few years, a strong desiccating process. All surface water has been carefully drained away, and the many square miles covered by London thoroughfares have been made quite as impermeable by asphalte,

or by the concrete foundation under the wood pavement, as are the roofed buildings which protect many more square miles of its surface. Whilst no water has gained access to the upper strata of the soil, the under surface water has been steadily drained away, leaving an increasing thickness of practically dry earth. The influence of this drying process, added to the smallness of the rainfall special to the Thames Valley, has been conducive to the health and comfort of the inhabitants, and it will again be referred to in connection with fogs.

II

THE LOCAL METEOROLOGY OF LONDON—WITH SPECIAL REFERENCE TO FOGS AND ATMOSPHERIC IMPURITIES.

THE Metropolis is too small an area to possess a regional climate of its own, yet sufficiently large and varied to present many local shades of climate, and these minor differences, but that they are toned down by artificial conditions, would not escape the notice even of casual observers. Because London is not a health resort most of its inhabitants have but little thought for any fine distinctions in climate and meteorology, and their attention is confined to some of the most striking contrasts. Two questions however are in a special degree "London Questions" and prominently before the mind of every Londoner,—The contamination of the atmosphere, and the prevalence of fogs, and these claim a passing notice.

London Air. Its Composition and its Impurities.—

We owe to Dr. W. J. Russell¹ important investigations on the relative composition and impurity of London air as compared with that of other air. His experiments were conducted by pumping air through a plug of glass-wool, and, in another series of observations, through a tube containing water. As a result of many experiments a close relationship was found to exist between the differences in the atmosphere and the amount of organic matter

¹ On *The Impurities in London Air*, by W. J. Russell, Ph.D., F.R.S. (reprinted from *The Monthly Weather Report of the Meteorological Office for August 1895*).

in the air. The amount of organic matter was arrived at by determining the amount of nitrogen and carbon in the samples collected, and the following figures were obtained (in grammes per 1,000 cubic feet), viz. :—

In fine weather :	Carbon,	·0033,	Nitrogen,	·0002,	Total organic matter,	·0035
„ dull „ „	„	·0101,	„	·0002,	„ „ „ „	·0103
„ foggy „ „	„	·0239,	„	·0005,	„ „ „ „	·0244

In order to ascertain the amount of sulphates, chlorides, and carbonic acid the air was artificially washed and the amounts in grammes determined in the washings for 1,000 cubic feet of air. A singular discrepancy from the results of an examination of rain-water was found in connection with the chlorides. Whilst the artificial method gave for the washings of 1,000 cubic feet an almost identical amount of sulphates, the amount of chlorides was three or four times less than that found in a litre of rain. This result, if any inherent defect in the method could be excluded, might suggest that since the washed air was obtained a few feet above the ground the chlorides in rain-water were partly derived from higher strata than the sulphates.

Putting aside this unexplained peculiarity, the experiments agree on the whole with the rain experiments in showing the influence of weather upon the relative purity of the atmosphere.

The average of various experiments performed at different seasons gave in grammes per 1,000 cubic feet of air :—

A. In fine weather :	H ₂ SO ₄ ,	·0128.	HCl,	·0010.
B. „ dull „ „	H ₂ SO ₄ ,	·0319.	HCl,	·0036.
C. „ foggy „ „	H ₂ SO ₄ ,	·0460.	HCl,	·0028.

and the volumes of carbonic acid in 10,000 volumes of air were 3·78, 4·5, and 5·1 respectively.

Important results were also obtained by examining the impurities in artificial dew obtained at the surface of a large glass funnel packed with ice. This method was found superior to the preceding one for the determination of ammonia, and gave results almost identical with those of the rain experiments as regards the proportion of chloride to sulphate, viz. 1—2·0 instead of 1—2·2.

Ammonia was found to vary as markedly as the chlorides and sulphates with the different states of the atmosphere, the average amounts in grammes for a litre of dew collected at St. Bartholomew's being :—

A. Fine weather:	H_2SO_4 ,	·0237.	HCl,	·0145.	NH_3 ,	·0034.	
B. Dull	„	H_2SO_4 ,	·0392.	HCl,	·0197.	NH_3 ,	·0055.
C. Foggy	„	H_2SO_4 ,	·0832.	HCl,	·0245.	NH_3 ,	·0110.

Dr. Russell concludes from his experience that “the composition of dew may be fairly taken as indicating correctly the relative purity of air.”

Local differences in the Purity of London Air.—Dr. Russell has proved that “chemical tests can readily distinguish town and country air, and even town from suburban air, and can strikingly show the difference in the composition of the air in the same place in different weathers.” Reference has already been made to the experiments on the composition of artificial dew at St. Bartholomew’s. Dew from the exceptionally pure air of Dartmoor gave only traces of sulphuric acid; very little hydrochloric acid (·0097 to ·0193); of ammonia only from ·0002 to ·0093; whilst the amount of oxygen required to oxidize the organic matter ranged from ·0031 to ·0056; whereas in London the amounts ranged from ·0265 to ·0420.

The examination of rain is of special value as indicating the state of the atmosphere at different times and places. Dr. Russell gives the following averages (including the averages of the oxygen necessary to oxidize the organic matter) for samples of rain collected simultaneously at St. Bartholomew’s and at Hamilton Terrace, St. John’s Wood, upon various dates in January and February:—

St. Bartholomew’s:	H_2SO_4 ,	·0241.	HCl,	·0131.	NH_3 ,	·0028.	O,	·0080.
Hamilton Terrace:	H_2SO_4 ,	·0135.	HCl,	·0093.	NH_3 ,	0023.	O,	·0061.

More recently an investigation on the contamination of the air of cities, and on the composition of fogs was set on foot and subsidized by the Manchester Field Naturalists’ Society, and, by special grant, by the Royal Society.

The following is extracted from the second report of the Air Analysis Committee on the Atmosphere of Manchester and Salford by G. H. Bailey, D.Sc. Ph.D.¹

(1) The maximum, minimum, and average amounts of sulphur for each month, expressed in milligrams of SO_2 per 100 cubic feet

¹ Cf. *Report and Proceedings of the Manchester Field Naturalists’ and Archaeologists’ Society for the year 1892.*

of air, are fully tabulated for four of the Manchester and Salford districts, and the following means were arrived at:—

Owens College, Nov. 1891—April 1892,	6·4	April—Nov. 1892,	2·7
Hulme	7·8	“	3·9
Town Hall	9·25	“	2·8
Ordsal	9·4	“	4·2 (?)

The amount of SO_3 in rain was found to vary from 6 to upwards of 40 per million. On December 19 to December 25 rime, collected on a glass plate, contained as much as 386 parts of sulphuric acid per million, and 9·2 grains of blacks per square yard. The chlorine in rain varies in the most extraordinary manner.

(2) The organic matter collected from air in the glass-wool-packing of an aspirating tube through which 200 cubic feet of air are drawn, is analyzed by determining the amount of reduction in a standard solution of potassium permanganate immediately after immersing the glass-wool, and at intervals of 1 hour, 6 hours, and 20 hours later, and a further reduction after 1 hour's duration at $50^\circ C$. The amount of the *ammonia* and therefore of the *nitrogen* is determined by distilling a known quantity with excess of alcohol, and Nesslerizing. The organic matter obtainable by this process was classified as: (1) putrescible, (2) less putrescible, (3) non-putrescible (soot and dust). These three classes of impurities showed considerable relative variations: thus on December 22 the more noxious kind was present in the proportion of 65 per cent. in the populous district of Ancoats, and less than 25 per cent. in the Owens College district, whilst the total amount of oxidizable matter was practically the same.

London Rain and its Impurities.—Dr. W. J. Russell's important investigations¹ on the impurities of *London rain* confirm the views expressed by Dr. Angus Smith in his work on *Air and Rain*, that an examination of the rain falling at any place gives much information concerning the composition and the impurities of the air of that place.

Numerous experiments showed that, contrary to a prevalent impression, London rain was never acid.

¹ I. *On London Rain*, and II. *On the Amount of Carbonic Acid in London Air*, by W. J. Russell, Ph.D., F.R.S., Lecturer on Chemistry at St. Bartholomew's Hospital Medical School: from the Appendix to the *Monthly Weather Report for April*, 1884.

Dr. Russell's estimations of the sulphates and chlorides expressed in grammes per litre of rain were performed volumetrically. They showed that, in the City, rain contains twice as much impurity as that collected at the suburban stations, and that, although the total amounts vary, the impurities at all the stations are in the same proportion. "Dilute the City rain with very nearly an equal bulk of water, and you have the rain of the suburbs." Thus the results found at St. Bartholomew's, Hamilton Terrace, N.W. and Shacklewell respectively, were as follows:—

St. Bartholomew's :	H ₂ SO ₄ ,	·0388.	HCl,	·0179.	Total	·0567.
Hamilton Terrace :	H ₂ SO ₄ ,	·0196.	HCl,	·0081.	..	·0307.
Shacklewell :	H ₂ SO ₄ ,	·0207.	HCl,	·0078.	..	·0285.

the proportions of chloride to sulphate being 1 ·2·2, 1 ·2·2, 1 ·2·6.

Comparative determinations brought out the fact that at all the stations the summer rain was more impure than the winter rain. At St. Bartholomew's the total amount of salts was nearly three times, at the other stations nearly twice as much in summer as in winter.

Again in summer there was found at each of the stations an increase in the amount of sulphates in excess of the increase of the chlorides, and Dr. Russell suggests as an explanation for this that the excess probably arises from the decomposition of animal and vegetable matter, volatile sulphur compounds being eliminated and afterwards oxidized.

The purifying effect of a good downpour of rain upon the atmosphere was also demonstrated by a series of experiments.

Rain in the country differs appreciably from that in London in the smaller amount of its impurities. Noticeable differences also arise from the varying proximity to the sea, as may appear from the results found at Rothamsted near St. Albans, by Messrs. Lawes, Gilbert, and Warington; at Slinfold near Horsham in Essex, and at Dartmoor, viz. :—

Rothamsted :	Sulphates,	·0040.	Chlorides,	·0033.	Proportion,	1·1·2.
Slinfold :	..	·0048.	..	·0041.	..	1·1·2.
Dartmoor :	..	·0005.	..	·0087.		

At Dartmoor the rain was collected during a south-westerly storm and probably gives the composition of pure air from the sea.

The Carbonic Acid in London Air.—For the determination of *carbonic acid* in the atmosphere of London, Pettenkofer's method was used, and the air was collected 12 feet above the

ground: 159 determinations were made in all varieties of weather including white as well as dense black fogs.

If the fog experiments be excluded, the volume of carbonic acid in 10,000 volumes of London air was shown to be 4.03, but in a subsequent series of more systematic experiments the average amount was only 3.96. This compares favourably with Dr. Angus Smith's results (in Manchester 4.03, in Perth 4.14, in Glasgow 5.02).

Roscoe and McDougall found in Manchester air 3.92 of carbonic acid.

Dr. Angus Smith determined the amount of carbonic acid in the air of London in 1864. The mean of five experiments was for the air of the parks 3.01 and for the air of the streets 3.80, and in 1869 he obtained the average 4.39 from 35 analyses of air taken from different parts of London. On the Scotch hills he had found in 1865 a proportion of 3.36 in 10,000 parts of air.

The *normal proportion* of carbonic acid in pure air has, according to Dr. Russell, been estimated a great deal too high (4 vols. in 10,000). The experiments of Schleutzer, Thorpe, G. F. Armstrong, Reiset, and those at the Mont-Souris Observatory agree in pointing to a lower estimate. The mean of this large aggregate of analyses is 3.03, which probably represents the amount of carbonic acid in the purest air.

Thus in London, in ordinary weather, the increase is only one part in 10,000 of air over the average. Nevertheless the variations, in London, are considerable. *Season*, which in the country does not modify the result in a marked degree, makes a great difference in London. Dr. Russell's experiments give for three winters a mean of 4.22 and for two summers that of 3.79.

Much more considerable are those variations which are due to weather, as it influences in opposite ways the circulation of air. Any marked diminution in the amount of carbonic acid coincides with bright weather and sunshine or with wind: and any marked increase, with dull and gloomy weather and still air; whilst the greatest accumulation of carbonic acid occurs in fogs.

It is significant that in the City the smallest percentages—3.0 and 3.3—were found by Dr. Russell on the August Bank Holiday of two different years, and the latter percentage also obtained on the Whit Monday.

The higher amounts, ranging from 5 upwards, occurred in dense

mists or fogs. The mean of 29 experiments on foggy days gave 7·2 parts in 10,000.

“The largest amount of carbonic acid found was 14·1 parts: this was on December 11th, 1882, during a long-continued fog. On referring to the table it will be seen that the fog had begun on the previous day, when there was a ‘thick white fog’ and the carbonic acid had then increased to 9·4; at noon on the 11th there was 11·0, and at 5 p.m. the carbonic acid had increased to 14·1 parts in the 10,000 of air, that is, there was more than three-and-a-half times the normal amount present.”

Dr. Russell concludes with the remark that “an increase of pure carbonic acid alone would be felt by most people, but an accumulation of carbonic acid means certainly a very large accumulation of other bodies, which probably are more, rather than less, deleterious than carbonic acid itself. The above experiments certainly confirm the impression that the carbonic acid, in town air, is a very important indication of its purity.”

LONDON SMOKE AND LONDON FOGS.

General Remarks.—Fog and smoke are separate but reciprocal inflictions. The thicker the smoke, the more likely the fog:—and the worse the fog so much the denser grows the smoke. Both evils are dependent upon stagnation of the atmosphere and are dispelled by wind.

One good word may perhaps be said for **London Smoke**. To those with a soul for scenery it is indirectly the source of some æsthetic enjoyment, and in that direction it cannot fail to exercise an educational influence upon all Londoners. Smoke which spoils everything else, beautifies London by disguising part of its ugliness. Much depressing architectural vulgarity is veiled in dreamy outlines: and like the gauze curtain on the stage, smoke lends the enchantment of distance to crude and commonplace detail. The few who lift their eyes to London sunsets find in them Turneresque beauties which are purely ideal and exceedingly gorgeous. It might also be suggested from a more material side, that in fast-living London over-wrought nerves may be soothed by this toning down of light and of outline. But when all has been said for the

advantages of smoke at a distance, it will be owned that closer contact with it, which is likely to remain a condition of existence in town, is unqualified misery.

London Fogs are the climax of evil and of suffering. Happily they are not our daily portion, but occasional visitors only, and they seem to be recurring with decreasing frequency.

The smoke nuisance is not confined to London. The country atmosphere also suffers. According to the Hon. R. Russell, half the counties of Surrey, Sussex, Buckinghamshire, Berkshire, Hertfordshire, Essex and Kent and the whole of Middlesex lose brightness of sunshine and part of their light; and the view is marred from Hampstead, Greenwich, Leith Hill, Box Hill, Shooter's Hill, Richmond, etc. The dulling effect is noticeable for a distance of forty miles or more. It is estimated by the same authority that the brown haze (which is by reflected light grey or blue) may deprive suburbs ten miles distant of two-thirds of their sunlight, places at a distance of twenty to thirty miles of half, and places at a distance of thirty to fifty miles of a quarter or less of it.

The evils of smoke in respect of **public health** are serious and far-reaching. In this connection Dr. J. B. Russell's cogent statements concerning the necessity of smoke suppression and its feasibility,¹ and the Hon. Rollo Russell's remarks on the same subject,² are worthy of perusal. The evils arising from a deprivation of sunshine and the contamination of the air with soot and other products of combustion are there set forth in more detail than can be admitted here.

A greatly increased mortality, chiefly from diseases of the respiratory organs, may be traced to this cause in the Registrar-General's returns. Dr. W. J. Russell, F.R.S., in a paper read before the International Congress of Hygiene and Demography, London, 1891, whilst recognizing the unwholesomeness of the atmosphere in a fog, states his opinion that "the great increase of mortality when fogs occur, is attributable rather to the sudden fall of temperature which usually accompanies fog than to the fog

¹ *The Evolution of the Function of Public Health Administration*, by James B. Russell, B.A., M.D., LL.D. : Glasgow, 1895, pp. 118 and 119.

² *Smoke in Relation to Fogs in London*: A Lecture delivered by the Hon. Rollo Russell. London, 1889.

itself." It has been shown that fogs act most detrimentally by confining the deleterious products of combustion within the lower strata of the atmosphere, and the other evils arising from smoke-laden fogs have also been dwelt upon.

This is not all. The unrecorded minor sufferings and disablements must be very great, and the indirect consequences on the health of individuals, beyond computation. Some idea of the detrimental effects of fogs and of coal-smoke upon the population may be imagined from the damage done to plant-life by London atmosphere.

Increased death-rate, lowered health, and depressed vitality are serious losses in themselves, but to them must be added the enormous financial cost of each day of fog, and the cost of repairing the destructive effects of smoke on valuable property throughout the year. A very large proportion of this destruction cannot be made good, and represents a dead loss without any other compensating advantage than the employment of labour in the extraordinary cleaning operations which become necessary, but too often are neglected.

Perhaps the chief amongst these destructive agencies is the depressing and demoralizing effect upon all, but particularly upon the house-wives of the poorer class. The struggle to keep things bright and tidy against the invasion of irrepressible and uncleanable dirt is a hopeless one, soon to be given up; and a lower standard governs the home. Much of the drunkenness of women may be traced to these physically and morally depressing influences.

The total suppression of smoke is the only adequate remedy. The evil could be mitigated by limiting the use and improving the combustion of coal, gas being used for cooking and for fires, and by the adoption of improved grates and kitcheners, and of hot-water pipes and other heating arrangements.

SMOKE AND ITS PREVENTION.

The Hon. Rollo Russell¹ calculates that 20,000,000,000 cubic feet of gas, the hourly output of a million chimneys each contributing 20,600 feet per hour, would give for the 100 square miles

¹ *Loc. cit.* p. 18.

of London a layer 7 feet in depth of smoky gas, or in twelve hours a layer of 85 feet. Fortunately the tendency of this layer is not to subside immediately. The extent to which it may rise as a huge column, or may stretch as an enormous streamer over the country, is for each day a question of the weather. The result depends upon the presence, the force, and the direction of the currents of air,—which fortunately are hardly ever completely absent in London even in a dead calm. The finest and stillest days are obviously not the most free from smoke.

Yet, in spite of its evil reputation, it is remarkable how clear the atmosphere of London can be at selected times in choice weather and particularly in the early morning. We cannot, however, be spared smoke for many hours together. With the lighting of breakfast fires London puts on its veil of carbon. Even in summer when each morning hour makes the air warmer and more capable of absorbing moisture, smoke intervenes between us and the noonday sun quite independently of any fog or mist.

In winter, when the shorter hours, and the scanty heat of our sunshine should be most treasured, the trouble grows. Some natural correctives operate on most days throughout the winter. When, however, owing to their temporary suspension, a mist arises, an acute complication sets in: we fail to get rid of our smoke, and the combined result of smoke and mist is a London fog.

Smoke Prevention.—An enormous improvement has taken place in the amount of London smoke since the Factories Act, but much more wants doing. The aggregate of London chimneys, at least during the winter, would contribute much more than the factories did prior to the passing of the Act, and this greater evil remains to be dealt with.

The Public Control Committee of the County Council take credit to themselves for having since June 1892 persistently reported the nuisance and transmitted particulars to the Sanitary authorities, and for having thus led the local authorities to enforce the Smoke provisions of the "Public Health (London) Act, 1891." Since 1893 great improvement has resulted, only isolated instances of nuisances from black smoke being observed; the numerous factories on Greenwich Marshes and the potteries on the Lambeth Embankment have in this respect given most trouble.

It is stated by Mr. A. E. Fletcher, in a paper published in 1892,

that the annual consumption of coal in London is about 1,250,000 tons, and that in Sheffield the same amount is consumed within an area of thirty square miles, whereas the area concerned in the case of London is 225 square miles.

Corresponding to this enormous consumption the amount of sulphur, calculated as sulphuric acid, would be no less than 37,500 tons. If this were washed down by the rain, 1,000 tons per square mile might be deposited in Sheffield. The amount which there falls suffices to rot stone, to destroy vegetation and kill the bark of trees—the plane-tree being found the most resistant and being for this reason almost exclusively planted—and to lower the health of the community. The invisible constituents of smoke—sulphurous acid, carbonic acid, and the chlorine compounds—are held to be much more injurious than the soot particles and the coal-dust: for it is well known that coal-miners so largely exposed to the latter are relatively free from consumption.

Dr. Littlejohn, in considering this subject, confines himself to the question of the prevention of smoke from manufacturing chimneys in Sheffield, where 600 tall chimneys serve 800 steam-boilers and furnaces, recognizing that any proposal for dealing with the question of smoke from house-fires can never be a local measure, but must be national in its scope and enforcement.

The time limits for permissible black smoke per hour have been reduced since 1892 from ten minutes to six; and Dr. Littlejohn believes that no hardship would be inflicted by a further reduction of the limits to the following:—

1 Boiler . . .	1 minute.
2 „ . . .	2 minutes.
3 „ . . .	3 „
4 „ or over. 5 „	„

with an exceptional extension to ten minutes during the first hour of the day.

A valuable report on “The Causes and Prevention of Smoke from Manufacturing Chimneys,” by Dr. Harvey Littlejohn, Medical Officer of Health for the City of Sheffield (March 20, 1897), to which are appended important contributions by Mr. A. E. Fletcher, late H.M. Chief Inspector under the Alkali Acts, and by Professor W. Ripper of the Technical School, contains historical references to the efforts made since the end of the last century, and parti-

cularly since the discovery of the steam-engine, for the abatement of the smoke nuisance. Select Committees of the House of Commons, appointed in 1819, 1843, and 1845, dealt with the subject exhaustively; and from the reports it appears that even at the earlier date the principles of smoke prevention were understood, and that various inventions had been successfully tried. The Committee of 1843 found that "smoke may in all cases be much diminished, if not entirely prevented," and urged the immediate introduction of legislation to prohibit the production of smoke from furnaces and from steam-engines. The Committee of 1845, appointed with that object, and the important report made to it by Sir Thomas de la Beche and Dr. Lyon Playfair, did not, however, lead to any comprehensive action on the part of the Government, but only to the sanctioning of clauses in the local improvement bills of various towns for the abatement of smoke.

The investigation of the General Board of Health brought about by Lord Palmerston, 1853—1855, disclosed the fact that a large number of firms had succeeded by simple means in diminishing or almost entirely suppressing their smoke.

In 1866 the Secretary of State obtained a return from the local authorities of fourteen large towns showing the number of convictions under "The Towns Improvement Clauses Act of 1847," and the satisfactory influence this exercised in lessening the evil. According to Dr. Littlejohn, the proceedings taken during the quarter century under the "Public Health Act of 1875," have fallen short of what might have been expected from the abundant evidence that smoke from steam-engines and furnaces can be almost entirely abolished, if not with a saving of expense, at least with little or no appreciable cost,—by efficient and careful stoking, by providing sufficient draught, and a sufficiency of boiler space.

THE NATURAL HISTORY OF FOGS; AND THE DECLINE OF THE LONDON FOGS.

Is the prevalence of London fogs spontaneously coming to an end? Recent years, although years of enormous expansion of the inhabited metropolitan area, have not been years of increasing but of decreasing frequency and intensity of fog. The view that the

fires in dwelling-houses are the chief offenders is supported by the fact that fogs were not infrequent on Sundays, and some of the most severe have occurred on Christmas Day when factories were inoperative.

If we adhere to approved notions as to the causation of fogs primarily through smoke, we must admit that in spite of the ever-increasing number of chimneys less smoke has been produced. There is indeed little doubt that a silent reform has been going on both in the construction of chimneys and grates, and in the more intelligent use of coal. Nevertheless it would be hard to believe that the total decrease in the output of smoke from private dwellings and factories can have been such as to account for the remarkable freedom observed of late.

Nay, it is not improbable that the total amount of smoke rising from the entire metropolis is greater than it was fifty years ago. The area of its production is however now vastly greater also, and there is thus less density of smoke contamination, a point which touches the question closely.

But smoke is not the only factor in a town fog. The paradox might be more completely explained if it were shown, as the writer believes it can be, that there has been less mist, and that in this respect as in some other the local climate of London, and of Greater London, has been undergoing a gradual alteration.

The Mutual Influences of Mist and of Smoke accumulation.—The area covered by London, it has often been pointed out, is not geographically or geologically more liable to fogs than many other areas of similar situation; and the Thames, so much abused, is not more productive of mists than other rivers. Rivers do not produce so much of it as is often supposed. On the other hand London has certainly been in the past an unduly misty and foggy place, greatly owing to the accumulation in the air of enormous volumes of smoke and to the resulting obscuration and loss of solar heat. Of late years, in spite of the amount and of the darkening influence of the smoke, there has been comparatively little mist: because the elements for its formation have not all been present.

Of the factors sharing in the production of mists, those which have undergone the greatest change are the conditions of the surface as regards moisture and temperature.

Building over of a stretch of fields or meadows, even in situations which are not exceptionally low, very often means the drying up of a surface which for many months in the year was damp or even wet. An instance in point, the more striking because of the relative altitude, is that of the Hampstead fields now partly covered by the Fitzjohn's Avenue. Their marshy condition in winter was such as to often render them impassable.

The cutting down of trees is an additional influence in the same direction.

The changes connected with building have proceeded over an immense area all round London as well as within it, and an enormous area of damp soil has been not only drained, but to a large extent built over on impervious cement or sealed by water-tight pavements.

A great deal of the mist traceable to surface moisture has thus been suppressed all around London, and the growth of the town has directly contributed in this sense to the lessening of the fog.¹

The Mode of Production of Fogs in London is, according to the Hon. Rollo Russell, who has for years devoted attention to the subject, connected with the following agencies:—

(1) The absence or presence of wind, and its direction and force.

(2) The state of the sky—whether clear or cloudy.

(3) The temperature of the upper air, that of the ground air, and that of the soil.

(4) The relative amount of moisture in the air and at the surface.

(5) The amount and the height of the mist.

(6) The quantity of smoke discharged into the atmosphere.

These factors combine and interact so closely that it would be difficult to consider them apart from each other.

We are familiar in London with two kinds of fog occurring at different altitudes. The proverbial London fog is a "ground fog," which may be white, yellow, or so-called "black." It has been

¹ This justifies a remark by the Hon. Rollo Russell (p. 15) *loc. cit.*—"If London were to burn nothing but anthracite and coal-gas, I have no doubt that owing to the conditions just mentioned, it would be compassed by a better climate and clearer air than that of the surrounding districts."

much less frequent of recent years, and of much shorter duration when it has occurred. The opposite type, between which and the first there may be gradations, is the "high fog," and this is not uncommon. It has considerable obscuring power and may be sufficiently dense to necessitate artificial lighting at mid-day,—but it does not impede the traffic, and it ranges above the houses probably to a considerable height. The ground atmosphere is not clear, but there is no fog, and, with the exception of damp places, such as the parks, no mist.

High fogs, even more markedly than others are, according to the Hon. Rollo Russell, almost invariably seen during anti-cyclonic phases, which are generally supposed to entail the descent of a vertical column of cold air. The warmer smoke ascending during the absence of any sweeping horizontal current at lower strata, meets the suspended moisture or "high mist" which is in this case produced at a high altitude: and the resulting fog settles at a level determined by its temperature and by that of the surrounding atmosphere. These fogs, which may for short periods remain limited even to parts of London, are instances of the "vertical production" of fog. They are dependent upon the meeting of upper currents of different temperatures and of small velocity.

The ground mist, when due to contact between a warm moist air with a much colder ground, is analogous to the light vapours which condense and cling around glacial mountain tops. This cold ground mist has no tendency to rise.

In explanation of the *vertical production* of dense high fogs, the Hon. Rollo Russell supposes that the currents are not superposed but meet by lateral contact throughout their thickness, which may be considerable, and thus lead to considerable darkness. "The area of effective moisture" and therefore of fog is not extensive: hence these high dark fogs, to which the smoke is seen to ascend straight because hemmed in by the converging currents, do not affect the whole metropolis at once, but travel slowly in the direction of the stronger of the two currents.

When the currents are superposed the condensation produced by their contact occurs over very large areas, often larger than that of the British Isles. The fogs which affect the whole of London and which remain for some time would be of this kind.

The upper current is commonly from the east, the lower current from the south-west; though sometimes *vice versâ* (as in 1880, —Hon. R. Russell).

The Influence of Temperature and Radiation.—The part which electricity may play in connection with the act of condensation of vapour and its possible influence “in attaching very small water particles to each other up to a certain size” is still imperfectly known and affords scope for further study by experts. Radiation is a recognized factor in the production of fogs, and its influence is well understood. Condensation has long been known to take place around floating particles in the air, as well as at the surface of terrestrial objects, and in determining its amount the temperature of soil and of air and the cooling effect of radiation are of direct importance.

A clear sky, by allowing the rising smoke to cool and to drop its carbon more rapidly, will enable the latter, as well as any suspended water particles to condense more and more moisture at their surface. A cloudy sky is, for the opposite reason, rarely associated with fog. Indeed “the passage of clouds over a ground fog speedily reduces its density,” radiation from the earth and from the water particles of the fog being now hindered.

Thus, in contrast with the ground fog formed near the cold soil by its contact with the warm moist air, when the warm air from London ascends into a clear cold atmosphere it sets up a high fog. It may even, as observed by the Hon. R. Russell,¹ carry with it enough vapour to produce a cumulus at the top of the dark column of smoke.

“The finest winter days are nearly always very bad ones in London unless there be wind between the surface and an altitude of 1,000 feet, or unless the dryness be unusual for the time of year.” Dry air and very moist air both prevent London fogs. Thus, as pointed out by the same authority,² those days upon which the country is streaming with wet mist are rarely foggy in London, showing the dependence of fog upon a dry upper air favouring radiation. In its absence much of the warmth of the smoke and of its particles is retained, and the atmosphere is not reduced below dew-point.

¹ *Loc. cit.* p. 12.

² *Loc. cit.* p. 8.

"If the sun dissipate the fog in the surrounding country warming the earth and the strata of air near it, thus getting slightly warmer around London than in it, the black fog may very likely remain upon the town all day." But commonly the advantage of two or three degrees of warmth which London possesses in winter over the surrounding country, favours this dispersion of the fog by causing an upward current and also by setting up slow currents of the colder suburban air to replace that which rises. Thus the heat arising from "the burning of 20,000 tons of coal from about a million fires in a day" sets the air into slow motion; and to this movement of air other circumstances also contribute, such as the inequalities in the temperature of streets and of buildings, the rush of traffic along thoroughfares, and through tunnels, and similar agencies.

The influence which must belong to radiation is demonstrated by the difference registered by a thermometer at the upper surface of a ground fog and at a height of 30 to 100 feet above it—the upper thermometer being the warmer. As pointed out by the Hon. Rollo Russell, radiation often occurs towards the cold ground, from suspended particles, among which carbon particles are good radiators, just as it occurs into space with a clear sky: this process is illustrated by the mists which form around mountain-tops. Fog is for this reason usually most dense at 8 to 10 a.m., at the time following the greatest cold at the earth's surface and when kitchen fires are being lighted.

The Relative Local Prevalence of Fogs.—In its coming and going a fog is often as fickle as the vane. This alone would render an accurate study of the local evidence of fogs extremely difficult. Moreover fogs vary from place to place in their composition and colour. In the light of foregoing remarks we might be tempted to predict the nature of these local differences, and to expect a white fog in the damp clayey suburban zone of Middlesex, and a yellow fog in dry, but smoke-stricken central London. Broadly speaking this is also our experience. Londoners are well aware that white fogs thicken at the approaches of parks, and are thickest within them. Indeed, of late, they have often been confined to the parks and to districts in the far West and North-west.

Beyond these general observations we have no reliable data

referring to London; but the following report from Manchester is instructive.

From a study of the fogs occurring in this city during the winter 1891-92 the following conclusions were drawn by the Air Analysis Committee, to whose labours reference has already been made in this Article.¹

(1) The fogs almost invariably coincided with a steady, or with a steadily rising barometer, especially when combined with a falling temperature.

(2) When partial, their occurrence was mainly in the vicinity of streams of water, some of the most suffocating and noxious occurring near the Irwell even when the rest of the city was almost clear.

(3) The most central parts of the city of Manchester were usually more free from fog than the surrounding area, particularly when the fogs were of short duration.

(4) In London the fogs, so far as the more central parts of the city are concerned, were rather more noxious and contained rather more sulphurous acid than the corresponding Manchester fogs. Liverpool has fewer fogs, and clearer air; and noxious fogs seldom occur—this is doubtless owing to its sea-breeze.

III.

THE WATER SUPPLY, AND THE METROPOLITAN WATER COMPANIES.²

THE earliest great *Water Company* was the "New River," inaugurated in 1613,—“it brought the water from Chadwell Spring in Hertfordshire, which is 110 feet above Ordnance datum, to the New River head at Clerkenwell, whence it was distributed through the City.”³

But the earliest *Water Works* in London were those constructed by Master Peter Morrys in 1582, by whom the two first of the nineteen narrow arches of Old London Bridge (North bank) were

¹ See pp. 17 and 19.

² *London Water Supply, including the History and Description of the London Water Works*, etc., by the late Col. Sir Francis Bolton, C.E.; new edition by Philip A. Scratchley, M.A., Barrister-at-Law: William Clowes and Sons, London, 1888. Also: *The London Water Supply, a Retrospect and a Survey*, by Richard Sisley, M.D., London, etc.: The Scientific Press, Limited, London 1899.

³ *London Ancient and Modern*, by G. V. Poore, M.D., F.R.C.P.

rented for 500 years, and fitted with water-wheels, which were capable ultimately of raising 2,000 gallons of water per minute a height of 120 feet, by a pipe passing over the tower of St. Magnus's church. This subsequently led to further arches being appropriated, and to others being closed to raise the force of the stream. This obstruction lasted for 240 years, until 1822, when the Act for rebuilding London Bridge caused their removal.

The Present Metropolitan Water Companies.—The great work of supplying London with water is at present conducted by eight Companies, and the area they supply extends over nearly 620 square miles. This vast area is altogether distinct from any of the many divisions under which Greater London or parts thereof is divided for several purposes: in the west, for instance, a large portion of Middlesex within Greater London is not included in what is known as "Water London," and again this is the case in Surrey to the south: on the other hand "Water London" extends beyond Greater London into Hertfordshire in the north, and also to a very large extent into Kent to the south-east. About 225 square miles of Greater London are not included in "Water London," while 144 square miles of this area lie outside Greater London.

In the Metropolitan water area and Greater London there are eleven Companies and ten local authorities, besides the eight Metropolitan Water Companies supplying water.

The names of the eight Metropolitan Water Companies together with their areas of supply, estimated population supplied, and the number of houses supplied in each area, as well as the average daily supply of each Company, the quantity supplied per house and per head of estimated population for the year 1898 are set out in the Table on the succeeding page.

The history of the Water Companies is one of increasing difficulty in obtaining a supply sufficient for the growing demand and water of the necessary purity; but it is also a record of gradual improvement under stress of legislation. Much however remains to be done. Among the reforms one of the most important has been the introduction and gradual extension of the constant supply system. In 1899 the Chelsea, East London, Grand Junction, Southwark and Vauxhall, and West Middlesex Water Companies, had extended this system to the whole of their areas within the County of London, while in other cases the percentages of hours

on constant supply were as follows: Kent 99·7, Lambeth 90, and New River 98·4.¹

Name of Company.	Area of Supply in Acres.	Estimated Population Supplied.	Number of Houses Supplied.	Average Daily Supply of each Company.	Daily Quantity Supplied	
					Per hour.	Per head of estimated population.
				Gallons.	Gallons.	Gallons.
Chelsea	3,482	279,518	37,978	11,853,571	312	42·40
East London . .	50,880	1,293,865	195,448	39,136,258	200	30·25
Grand Junction .	29,760	406,250	62,693	19,804,675	316	48·75
Kent	113,280	527,886	87,981	16,349,433	186	30·97
Lambeth	39,360	686,194	109,967	25,234,360	229	36·77
New River . . .	59,520	1,192,371	164,465	37,587,688	228	31·52
Southwark and Vauxhall . . .	19,040	816,895	121,743	32,743,059	269	40·08
West Middlesex .	17,280	611,240	82,600	21,344,911	258	34·92
Total and Means	332,602	5,814,219	862,875	204,053,955	236	35·09

The Source of Supply.—This differs much in the case of the various Companies, some of which derive their water from several sources, and which are set out in the following table compiled from the Water Examiner's monthly reports for 1898. The capacity of each Company's service reservoirs for water ready for immediate supply at the end of 1898 is also given:—

Name of Company.	The Thames.	The Lea.	Springs and Wells.	Ponds (for non-domestic purposes).	Total.	Capacity of Reservoirs.
	Million Gallons.	Million Gallons.	Million Gallons.	Million Gallons.	Million Gallons.	Million Gallons.
Chelsea	11·85	—	—	—	11·85	11·00
East London . .	7·82	24·12	7·18	—	39·12	20·80
Grand Junction .	19·79	—	—	—	19·79	76·00
Kent	—	—	16·38	—	16·38	13·62
Lambeth	25·22	—	—	—	25·22	28·77
New River . . .	·48	20·07	16·90	·10	37·55	37·54
Southwark and Vauxhall . . .	30·83	—	1·91	—	32·74	19·00
West Middlesex .	21·33	—	—	—	21·33	19·42
Total	117·32	44·19	42·37	·10	203·98	226·15

¹ *London Statistics*, 1898–99, pp. liii–lvi, published by the London County Council.

The pumping-stations of intake and the reservoirs are for the Chelsea Water Works at Walton and West Molesey; for the East London at Waltham on the Lea and Sunbury on the Thames; for the Grand Junction Company at Hampton in the county of Middlesex opposite Platt's Eyot; for the Lambeth at West Molesey; for the New River Company near Hertford; for the Southwark and Vauxhall Company at Hampton opposite Platt's Eyot; for the West Middlesex Company at Hampton; and for the Kent Company at Maiden Brooks in the parish of Crayford.

The London County Council has almost from its inception endeavoured by legislation to obtain control over the London Water Companies by purchase, and for the last few years it has deposited bills in Parliament each Session with this object, but with no success. In 1897 a Royal Commission was appointed to inquire into the Water Question, and in its Report the important recommendation was made, "That having regard to the prospective requirements of supply in 'Water London,' we are of opinion that it is desirable that the undertakings of the Water Companies should be acquired and managed by a public authority." The inducements held out by the Commissioners for this recommendation are (1) an improvement in quality; (2) a higher pressure; (3) the prevention of failure of supply; (4) the prevention of waste; (5) provision for future requirements; and (6) incapacity of the Companies to meet future demands. The Commissioners however objected for several reasons to the County Council becoming the water authority, and suggested the establishment of a "Water Board" of a permanent character consisting of thirty members.

In 1900 the County Council again decided to deposit bills for the purchase of the Companies, but with no chance of success, as it was intimated by the President of the Local Government Board to a deputation of the Council that waited upon him in the meantime, that it was the intention of the Government to bring in a bill itself in 1902 dealing with the Water Supply of London, but he was unable to state what form this legislation would take.

THE DANGERS CONNECTED WITH THE WATER SUPPLY AND ITS DEFECTS.

The water supply is the most urgent question of the day, and one intimately related to that of the disposal of sewage. The possibility of a widespread diffusion of disease by drinking water has been sufficiently illustrated by the lamentable experiences of Worthing and Maidstone. For instances of anything approaching these epidemics we must look back to the period when water was distributed to London and other towns from rivers flowing with actual sewage. The risk is one inseparable from the system of wholesale storage and distribution of water, and therefore the present position is still one of considerable insecurity as regards possible *impurity of water* and *possibilities of infection*. The following objections may be urged against it:—

(1) The first objection is of a *general* character and inherent to the practice of supplying London from neighbouring rivers. River water can never be proved to be absolutely safe; but more serious dangers arise in connection with the possible leakage from sewers.

(2) A *definite* indictment of direct pollution with sewage has been raised against the supply from the river Lea, and fully proved. Hitherto, however, the efforts of the press, and in particular of the *Lancet*, which has published from time to time during 1896 and 1897 the findings of its Special Commissions on the Water Supply to the Metropolis, and the litigation of the East London Water Company against the Hertford Corporation,¹ have not secured adequate improvement.

The pollution of the river Brent recently much complained of in the medical and in the general press² is also a standing danger, although its waters are collected for navigation purposes only.

(3) Another definite evil is the growing depletion of the rivers, with its obvious and varied dangers.

(4) Yet more serious is the restricted supply prevailing in some

¹ Cf. *Annual Report of the Proceedings of the Council for the year ending March 31, 1896*, p. 118 *et seq.*

² Cf. *Special Report on the Condition of the River Brent*, by F. Bailey Denton, M. Inst. C.E. : *Brit. Med. Journal*, Aug. 21, 1897, p. 49.

districts and the possibility of a water famine, such as that which occurred in 1896.¹

THE ANCIENT LONDON SPAS.

The old is so intimately blended with the new in much that relates to London, that a brief reference to its former Spas may not be out of place; but a description of the Baths and Wells of Great Britain having been included in the first volume of this Report, a very brief allusion to this subject will suffice. My thanks are due to Dr. Clippingdale of Notting Hill for his valuable assistance in connection with the literature of this subject. Much of our information is to be found in Mr. Wroth's recent work.²

London and its surroundings possess a variety of mild medicinal springs, each of which has had its day of fame. The Spas are now extinct, but in most cases the names remain, and some of the once famous waters still flow from inconspicuous fountains among the many which supply common drinking-water.

Bagnigge Wells, in the lower ground between the Foundling Hospital and the head of the New River, came into repute under George III. for its saline and purgative waters and for its attractions. The gardens, which were traversed by the Fleet in its course towards Blackfriars, remained open as late as the beginning of this century.

Sadlers Wells. The chalybeate spring identified with this name was discovered at the end of the seventeenth century, and much patronized by Londoners during the first half of the eighteenth century. Its prosperity as a pleasure resort has, however, outlasted its medicinal reputation.

Little is known concerning the wells of **St. Pancras** and of **St. Chad**, the waters of which were derived from the neighbourhood of Hampstead.

In the suburbs, the most famous Spas were those of **Hampstead** and of **Islington**. The popularity of the carbonated chalybeate water of Hampstead seems to have had two periods—during the

¹ Cf. *Council's Annual Report*: *loc. cit.* p. 125.

² *The London Pleasure Gardens of the Eighteenth Century*, by Warwick Wroth, F.S.A.: Macmillan and Co., London and New York, 1896.

Heptarchy, and again from the reign of Charles II. to the beginning of this century, when the water was still bottled and found a sale in London.

West of Hampstead, **Kilburn Spa** was connected with a rivulet formerly flowing through Bayswater to the Thames at Pimlico Pier. It seems to have been the fate of the metropolitan Spas to degenerate into places of amusement where alcoholic beverages were ultimately sold. This was the destiny of the once famous chalybeate spring of Islington, which was connected with the "**London Spa**" and the "New Wells."

Streatham possessed mineral springs, the waters of which were aperient, and, according to some accounts, were used as late as 1817 in the London Hospital.

On **Brixton Hill** a bromo-ioduretted spring is stated by the same writer to have been discovered within recent times.

Dulwich was noted, during the first half of the eighteenth century, for its sulphuretted and chalybeate spring.

Beulah Spa was in vogue during the early part of the nineteenth century in connection with its muriated and sulphated waters.

Lambeth Wells are also stated to have supplied a purgative saline water used at one time in St. Thomas's Hospital.

Mineralized waters were also obtained in various other suburban districts including Bermondsey (chalybeate), St. George's Fields (sulphuretted), Acton (saline), and Shadwell.

BATHS AND WASHHOUSES.¹

The multiplication of Public Baths and Washhouses is one of the greatest boons conferred by modern municipal activity. The first Act of Parliament authorizing Local Authorities to establish baths and washhouses was that of 9 and 10 Vic. cap. 74 [1846], and in addition to this Act four amending Acts have since been passed.

Up to the end of 1899 there were thirty-five parishes in London in which the Acts have been adopted, and in twenty-nine of these

¹ This information is taken from a return relating to public baths and washhouses and public libraries, published by the London County Council, dated November 1899.

the establishments are in full working order, in five the buildings are in course of erection or under consideration, but in Plumstead the matter has been allowed to drop owing to lack of a suitable site.

The Table (p. 45) gives particulars of those in working order.

Of the 887 1st class private baths 247 are for females only, while of the 1,652 2nd class 447 are set aside for females.

The number of bathers in the year 1897-8 using the private baths were: 1st class, 650,338, 2nd class 1,697,620, total 2,347,958; while those using the swimming baths were: 1st class 705,456, 2nd and 3rd class 1,409,695, total 2,115,151; or a grand total of 4,463,109 using the private and swimming baths: in addition to these no less than 627,881 women used the washhouses during that year.

DRAINAGE.

THE SEWERS AND SEWERAGE OF LONDON.

The northern half of London is served by three sewers: (1) The northern high level sewer, traversing South Hampstead, Kentish Town, Upper Holloway to the foot of Stamford Hill, Lower Clapton, Homerton, Hackney, and through Victoria Park to Old Ford, where it is joined by (2) the middle level sewer. The latter, starting from the north of the parish of Kensington, is crossed between Paddington Station and the Serpentine by the sewer which extends from West End, Hampstead, to Pimlico, joins the Bayswater Road, east of Ladbrook Grove, and follows this road, Oxford Street, Old Street, Bethnal Green Road and Green Street to Old Ford, receiving east of the British Museum the Piccadilly branch.

(3) The northern low level sewer, beginning under the name of the western sewer and receiving the Fulham branch south of Walham Green and the Acton branch at Chelsea, follows the bank of the Thames from opposite the West London Extension Railway Bridge to Blackfriars Bridge. Close to the Chelsea Bridge the western pumping station gives a lift of 18 feet. Beyond Blackfriars, the sewer leaves the bank of the Thames

TABLE SHOWING THE BATHS AND WASHHOUSES OF LONDON IN USE IN THE YEAR 1899.

PARISH.	PRIVATE BATHS.			SWIMMING BATHS.		WASH- HOUSES.	
	1st Class Baths.	2nd Class Baths.	Total Number of Private Baths.	For Females exclusively.	Total Number of Swimming Baths.	Number of Establishments.	Number of Washing Compartments.
Battersea	19	51	70	—	3	—	—
Bermondsey	20	43	63	—	2	1	75
Bow	19	38	57	—	2	1	40
Camberwell	60	93	153	—	4	1	72
Chelsea	24	83	107	2	5	—	—
Deptford, St. Paul	20	40	60	—	2	1	23
Greenwich	17	26	43	—	2	1	16
Hackney	24	60	84	1	3	—	—
Hampstead	20	28	48	2	4	—	—
Islington	78	207	285	3	9	3	186
Kensington	20	54	74	1	4	1	60
Lambeth	30	64	94	1	3	1	64
Lewisham	18	38	56	—	4	—	—
Newington	21	38	59	1	3	1	72
Paddington	38	58	96	1	4	1	50
Poplar	21	29	50	—	2	1	40
Rotherhithe	33	32	65	—	2	1	36
St. George in the East	17	26	43	—	1	1	30
St. George, Hanover Square	54	69	123	—	3	2	76
St. Giles and St. George	25	47	72	—	2	1	58
St. James, Westminster	36	54	90	—	2	1	84
St. Margaret and St. John's	28	34	62	—	2	1	64
St. Martin in the Fields	22	38	60	—	—	1	60
St. Marylebone	34	67	101	1	4	1	74
St. Pancras	82	135	217	—	4	2	141
St. Saviour's, Southwark	17	33	50	—	2	1	36
Shoreditch	25	51	76	—	2	1	50
Whitechapel	40	78	118	1	3	—	—
Woolwich	25	38	63	—	2	—	—
TOTALS	887	1,652	2,539	14	85	26	1,407

and passes north of the Tower and the London and St. Katherine's Docks through Limehouse and Bromley to the Abbey Mills pumping station, where it joins the northern outfall sewer from Old Ford (at Abbey Mills pumping station the sewage being lifted 36 feet). The course of the northern outfall sewer is then a direct one through Plaistow and East Ham to the Barking Reservoir and Precipitation Works.

(4) In the southern half of London the southern low level sewer begins at Putney, west of the bridge, follows Wandsworth Lane, York Road and Battersea Road to Vauxhall and the Oval, thence to and along Albany Road and Old Kent Road to the Deptford pumping station (lift 18 feet), shortly before reaching which it is joined by the Bermondsey branch at Evelyn Street. It meets the other sewers at Deptford and forms with them the southern outfall sewer which underlies the Greenwich and Woolwich Lower Road, passing through Charlton and Woolwich and across the Plumstead and Erith Marshes to the Crossness Pumping Station and Precipitation Works (lift 10 feet to 30 feet, variable).

(5) The southern high level sewer begins with two branches from Roehampton and from Wimbledon Park and proceeds to Wandsworth where a branch connects it with the lower level sewer, then on to Wandsworth Common where it is met by the "Old Falcon Brook," which again joins it with the low level sewer. At Clapham it is joined by the Balham Road sewer, which commences at Streatham Common and passes through Tooting and Balham; at Stockwell Road by the King's Road sewer, and at Stockwell by the Brixton Road sewer, from Lower Norwood, which connects with the Effra sewer. From Stockwell this sewer passes on through Camberwell and Peckham to New Cross and thence to the meeting-point of the sewers at Deptford.

(6) The Effra branch sewer collects from Lower Norwood and Crystal Palace, Tulse Hill, Dulwich and East Dulwich, Nunhead, Peckham and New Cross, where it meets the Bell Green and Lewisham Road sewer as well as the Lee Green sewer which starts from New Eltham and from Mottingham.

Additional sewers which were proposed by Sir Benjamin Baker and Sir Alexander Binnie in their joint report to the County Council in 1891 are the following: A main sewer from Pad-

dington passing through Regent's Park, King's Cross, to Islington and Old Ford, and two northern outfall sewers to serve in addition to the existing one;—and in South London, a main sewer starting from Balham and from Streatham and passing through Dulwich, Forest Hill, Brockley, Bushey Green, Lee, Blackheath, Charlton, Woolwich and Plumstead, where it would enter a new outfall sewer starting from Deptford. These recommendations have not, however, been adopted, the result being that with the exception of a few minor works, which have tended to relieve certain districts, the main drainage system of London has not advanced in the same ratio as the requirements of a largely increased population.

The storage and precipitation works at Barking, which were completed in 1889, consist of storage reservoirs and of 13 precipitation channels (30 feet deep, 860 to 1,210 feet long, capacity 20,000,000 gallons). Part of the clarified effluent passes into the old reservoir, the rest straight into the river. The chemical treatment which was originally intermittent but is now continuous, was devised by Mr. Dibden, chemist to the Council, with a view to restricting the bulk of sludge to a minimum. It consists in adding 1 grain of proto-sulphate of iron and 4 grains of lime to each gallon of sewage.

The new works commenced in 1888, and now completed, consist of four precipitation tanks with a capacity of 6,250,000 gallons each, and two smaller ones of half the size of the above, making in all a total of over 31,000,000 gallons of precipitation reservoir capacity.

The black and somewhat offensive sludge (nine parts water, one part solid) is conveyed at a cost of under 9*d.* per ton in the six sludge ships, each capable of carrying 1,000 tons, to the "Barrow Deep" beyond Southend and Shoeburyness, to be distributed over a distance of some eight to ten miles of sea-water. This method of discharging the sludge into the sea is also that adopted on the Tyne, on the Tees, on the Forth, and on the Clyde.

The Present Defects in the System of Sewers and Sewerage, and the Remedies proposed.—In spite of the vast advance which has been made, an ideal system has not yet been attained, nor can it be. Any increase in the "dry weather" sewage arising from an increase in the population might from time to time be provided for; but the more the inhabited area is extended the less will it be possible to prevent the drainage from taking during

heavy rains its natural course into the rivers. Under the present system, devised by Sir John Bazalgette, a periodical discharge of much sewage together with quantities of storm water takes place through overflow sewers into the Thames. This evil is especially serious in the case of a tidal river. Doubtless much organic matter may be oxidized away and diluted by the bulk of rain-water; but some must sink and add to the organic deposit accumulated for generations at the bottom of the river. This is a recognized, but hitherto uncorrected evil.

Still more serious, however, is the permanent contamination of the river Lea, which practically serves as a sewer to a large district, and ultimately pollutes the Thames. This is mainly due to the defective discharging capacity of the outflowing sewers. Thus the discharging capacity of the sewers from Old Ford to Abbey Mills is only 22,000 cubic feet per minute; whilst the joint discharging capacity of the high and low level sewers to Old Ford is about 39,000 cubic feet per minute, which means that when the latter are running full an overflow must occur in the Lea of 17,000 cubic feet per minute.

In their joint Report on the Main Drainage of London to the County Council (February 1891), from which most of the present statements are culled, Sir Benjamin Baker and Sir Alexander R. Binnie state that in dry weather the high and the middle level sewers are sufficient, the flow within them being only 18 to 23 per cent. of their discharging capacity; the Bayswater Road sewer, however, is inadequate, the regular flow being 30 per cent. within it. But the low level sewer is much overtaxed, its dry weather flow being about 70 per cent. of the discharging capacity. Frequent floodings occur in the riverside flats in spite of the thirty-four storm overflows into the Thames. These are calculated to discharge on an average for six hours in every week. On the south side of the Thames the position is even worse, for although the southern low level and Bermondsey branch sewers' discharge can be easily dealt with, the total discharging power of the high level and Effra sewers is 34,000 cubic feet per minute. Of this amount only 8,000 cubic feet can pass through the pipes under Deptford Creek, so that there must be an overflow into this creek of no less than 26,000 cubic feet per minute, when these sewers are fully charged. Again the capacity of the southern outfall sewer

would seem to be far short of requirements, as its capacity to carry forward sewage from Deptford is only 15,000 cubic feet per minute after deducting the intakings from Charlton, Greenwich, Woolwich and Plumstead into this outfall.

Objections may be raised to this method of disposal, and improvements may be suggested, but the Report in question has not recommended any radical change in the principles except the construction of new intercepting sewers on both sides of the river sufficient to provide for the sewage of a future population of seven millions, and for a fair amount of rainfall. The present average flow at Barking being at the rate of 100 million gallons per day, and that at Crossness at the rate of 80 million gallons, the extra capacity would contemplate an additional 100 million gallons of average dry weather flow. It also recommends that the entire future effluent be not discharged at Crossness and Barking, but that a new outfall be provided for part of it nearer the sea, and probably at Shell Haven in Sea Reach, where the sewage might also undergo treatment. This latter part of the proposed improvement they do not regard as urgent.

In a further report made in 1899 to the County Council by Sir Alexander Binnie, the Council's Chief Engineer, he states that in the years 1895-7 the average dry weather discharge of sewage at Barking and Crossness was $115\frac{1}{2}$ and $79\frac{1}{4}$ million gallons a day, or over 86 million gallons per day more than the quantity the sewers were designed to discharge. The report also points out that the main drainage system was not originally intended to take the drainage from districts outside the metropolitan boundary, such as Acton, Willesden, Tottenham and Wood Green, Hornsey, West Ham, Beckenham, etc., the sewage of which is now partly or wholly admitted. The conclusion which Sir Alexander Binnie arrives at in this Report is that the County Council be asked to sanction the construction of two new sewers from Barking to Abbey Mills, and extra works at the former place, a new sewer between Deptford and Crossness, and one from Catford to Crossness; and that the sewer between Deptford and Crossness, which is the one most urgently needed, should, if possible, be taken in hand first.

The sewage question in the suburban areas of Middlesex as well as of Essex and Kent is also anxious and urgent. The local difficulties of the disposal of sewage which may have originally been

slight become considerable whenever a village grows into a suburban town, and the task of carrying out in their perfection the best approved sanitary principles may sometimes be almost impossible. The Brent and the Lea are both instances showing how the slight contamination which originally prevailed may grow with the increase of the population to dangerous proportions. To these defects and to those of the water supply, a series of articles in the *Lancet* has done good work in calling renewed attention, and the local authorities are now being moved to take action. Both the Brent and the Lea have been, and to some extent are, practical sewers for part of their course, and in the case of the Brent the evil periodically becomes a danger when dry weather, such as that of the summer of 1897, or an increase in the amount of water withdrawn for the service of the canal causes the level to fall and the river to become almost stagnant.

Amount of sewage dealt with yearly, and the cost involved.

—In a Return printed by order of the Main Drainage Committee of the London County Council, dealing with the treatment and disposal of London sewage during 1899, some interesting figures are given with reference to the work done and the quantity of sewage treated, together with the cost of treatment.

During the year no less than 77,019 $\frac{3}{4}$ million gallons were treated; 45,011 $\frac{1}{2}$ million gallons at the Barking outfall north of the Thames, and 32,008 $\frac{1}{4}$ million gallons at the Crossness outfall on the south side of the Thames. This enormous quantity produced no less than 2,290,000 tons of sludge, of which 92·08 per cent. consisted of moisture, and the remaining 7·92 per cent., or 181,400 tons, of solids.

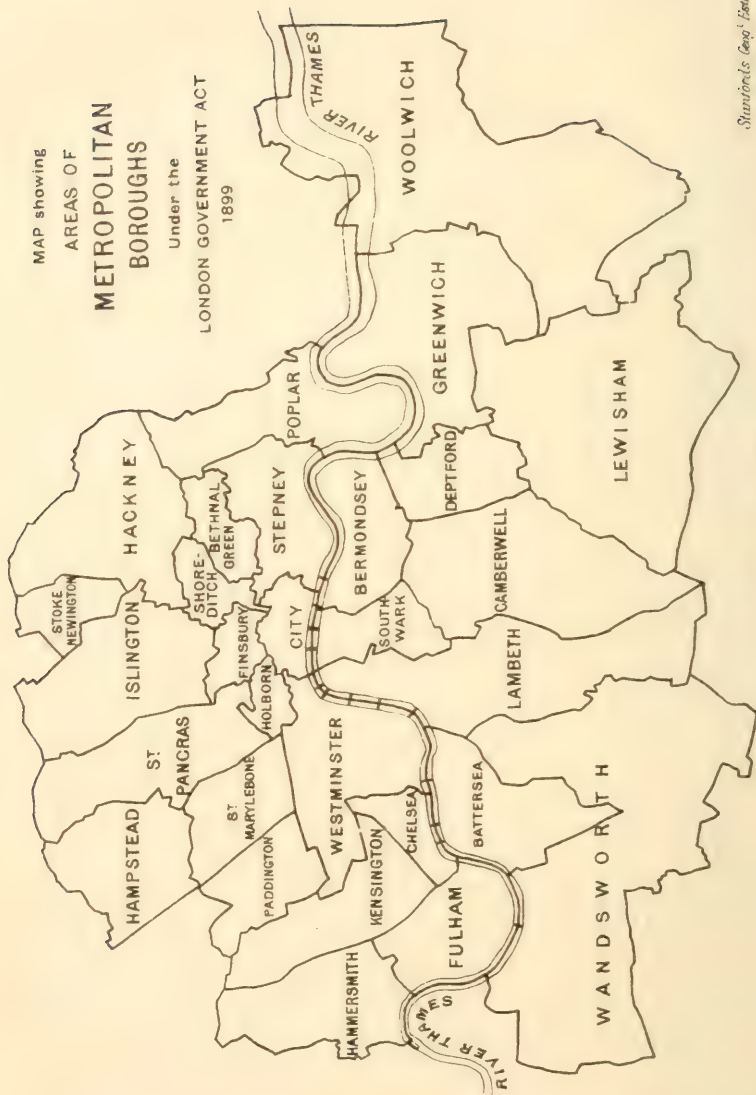
The chemicals used in the precipitation works amounted to 20,977·5 tons of lime and 4,938·9 tons of protosulphate of iron.

The Council had, in 1899, six sludge vessels capable of carrying an average of 1,000 tons each; these vessels made during the year 2,290 trips to and from the Barrow Deep, where the sludge is deposited over a distance of say one hundred miles for the round trip.

The total average cost for treating the crude sewage, filtering ·5 per cent. of the effluent at Barking, and conveying the sludge to the sea was £2 1s. 10·16d. per million gallons.

The quantity of sludge sent to sea, 2,290,000 tons, would cover

1899



London Macmillan & Co. L^{td}

Sturion's Cong. Estab^d

Hyde Park (400 acres), to a depth of 4 ft. 6½ in., or Battersea Park (198 acres), 9 ft. 2 in.

The mean rainfall for 1899, as taken at the Council's three main pumping stations and at Barking and Cross outfalls, was 21·16 inches, an increase as compared with that of 1898 of 5·22 inches.

The total number of discharges from the Council's sewers on the north side of the Thames into that river and the sea on account of rainfall was 830, and the total duration of such discharges 3,998 hours.

IV.

THE MORTALITY AND THE DEATH-RATE IN THE COUNTY OF LONDON AND IN ITS DISTRICTS.

GENERAL REMARKS.

THE mortality among the inhabitants of the entire area of Greater London was in 1899¹ at the rate of 18·3 per 1,000, as compared with 17·0, 16·7, and 17·2 in the three preceding years respectively. In Inner, or Registration London, the mortality was at the rate of 19·8 per 1,000, while in the Outer Ring it did not exceed 14·8. Infantile mortality in Greater London was at the rate of 165 per 1,000 births, as compared with 155, 155, and 164 in the three preceding years. The proportion in Inner London was 166, and in the Outer Ring 160 per 1,000 births.

Broadly speaking, the more populous and central a district, so much the higher the mortality within it; but to this there are reservations, and particularly that which arises in connection with the mortality in Institutions contained within the district.

Essentially in itself the mortality among the poor need not be greater—often indeed it is less—than that among the rich. This may be seen in rural districts. “Town-poverty” is more deadly. Its ranks are made up of starved and poisoned constitutions and of their offspring. It is upon this devitalized material that the evil of overcrowding tells with unresisted force. For a remedy to this the philanthropist is as largely needed as the sanitarian. Indeed it might be argued that the sanitarian has accomplished a

¹ *Registrar-General's Annual Summary*, 1899.

great part of his work and that the task of philanthropy now remains the larger one.

The Comparative Death-rate in the Several Sanitary Districts.—This is the mathematical foundation of the study of our Metropolitan Hygiene, and it is now possible to compare the “corrected” as well as the “crude” mortality of each of the sanitary areas with those of London (represented by the figure 1,000), which in 1899 was, “corrected” 20·6, and “crude” 19·3. A comparison is also made between the standard death-rates (England and Wales 19·15, and London 17·96), the crude death-rates (London for 1889-98, 19·2, and for 1899, 19·3), and the corrected death-rates (London for 1889-98, 20·5, and for 1899, 20·6).

The differences included between the extremes in the sanitary areas, (650 in Hampstead and 1,490 in St. Luke, a range of considerably over 40 per cent.) give us food for serious thought.

The annexed Table shows in detail the crude death-rates and the death-rates corrected for differences in the age and sex constitution of the populations obtaining in each of the sanitary districts of London for the year 1899 (52 weeks) and for the period 1889-98.

It will be seen that all the eastern districts and all the central districts, with the exception of St. Martin-in-the-Fields, had in the year 1899 death-rates above the average of London.

We are struck, however, by the unevenness of the figures returned from the various districts. The latter may be divided in respect of their relative mortality (pro mille) into three groups: (1) with heavy mortality, (2) with intermediate mortality, and (3) with light mortality.

In group 1 we find among the seats of heavy mortality (1,200 and over) Clerkenwell, Newington, Westminster, Bermondsey, St. Olave, St. Saviour, Strand, Holborn, Limehouse, St. George-in-the-East, St. George Southwark, and St. Luke, the latter being 1,490.

Group 2, with an intermediate mortality (between 1,000 to 1,200), includes Chelsea, St. Pancras, Rotherhithe, Mile End Old Town, St. Giles, Whitechapel, Poplar, Bethnal Green, Woolwich, Shoreditch, and the City of London.

Group 3 comprises the seats of light mortality (under 1,000):—Hampstead, Stoke Newington, Plumstead, St. George Hanover Square, Wandsworth, Lewisham, Lee, Paddington, Hackney,

CRUDE AND CORRECTED DEATH-RATES PER 1,000 PERSONS LIVING IN SANITARY DISTRICTS OF LONDON.

Sanitary Area.	Standard death-rate.	Factor for correction for age and sex distribution.	Crude death-rate, 1889-98.	Corrected death-rate, 1889-98.	Comparative mortality figure, 1889-98. (London 1,000.)	Crude death-rate, 1899.	Corrected death-rate, 1899.	Comparative mortality figure, 1899. (London 1,000.)
<i>England and Wales</i>	<i>19.15</i>	—	—	—	—	—	—	—
London	17.96	1.06626	19.2	20.5	1,000	19.3	20.6	1,000
Battersea	17.80	1.07584	17.6	18.9	922	16.7	18.0	874
Bermondsey	18.10	1.05801	22.1	23.4	1,141	24.1	25.5	1,238
Bethnal-green	18.39	1.04133	22.8	23.7	1,156	22.8	23.7	1,150
Camberwell	18.10	1.05801	17.9	18.9	922	17.4	18.4	893
Chelsea	17.95	1.06685	19.4	20.7	1,010	19.6	20.9	1,015
Clerkenwell	17.28	1.10822	22.8	25.3	1,234	22.6	25.0	1,214
Fulham	18.27	1.04817	18.9	19.8	966	19.2	20.1	976
Greenwich	18.63	1.02791	18.9	19.4	946	18.8	19.3	937
Hackney	18.30	1.04645	—	—	—	16.9	17.7	859
Hammersmith	18.05	1.06094	18.3	19.4	946	19.0	20.2	981
Hampstead	16.63	1.15153	12.2	14.0	683	11.6	13.4	650
Holborn	17.62	1.08683	25.5	27.7	1,351	24.9	27.1	1,316
Islington	17.90	1.06983	17.7	18.9	922	18.1	19.4	942
Kensington	17.38	1.10184	16.7	18.4	898	17.7	19.5	947
Lambeth	18.24	1.04989	18.9	19.8	966	19.2	20.2	981
Lee	17.67	1.08376	14.8	16.0	780	15.1	16.4	796
Lewisham	17.92	1.06864	13.8	14.7	717	15.7	16.8	816
Limehouse	17.59	1.08869	25.2	27.4	1,337	25.6	27.9	1,345
London, City of	16.65	1.15015	22.0	25.3	1,234	21.5	24.7	1,199
Mile-end Old-town	18.58	1.03068	21.1	21.7	1,059	21.3	22.0	1,068
Newington	18.32	1.04531	22.4	23.4	1,141	24.0	25.1	1,218
Paddington	17.72	1.08070	16.3	17.6	859	16.1	17.4	845
Plumstead	19.09	1.00314	15.7	15.7	766	14.3	14.3	694
Poplar	18.49	1.03569	21.2	22.0	1,073	22.1	22.9	1,112
Rotherhithe	18.49	1.03569	20.7	21.4	1,044	21.1	21.9	1,063
St. George, Hanover-square	17.34	1.10438	15.0	16.6	810	14.2	15.7	762
St. George-in-the-East	18.43	1.03907	27.8	28.9	1,410	27.1	28.2	1,369
St. George, Southwark	17.35	1.10375	25.2	27.8	1,356	27.7	30.6	1,485
St. Giles	17.27	1.10886	22.3	24.7	1,205	19.9	22.1	1,073
St. James	17.16	1.11597	18.5	20.6	1,005	17.9	20.0	971
St. Luke	17.72	1.08070	26.9	29.1	1,420	28.4	30.7	1,490
St. Martin-in-the-Fields	15.74	1.21665	19.8	24.1	1,176	15.6	19.0	922
St. Marylebone	17.82	1.07464	20.5	22.0	1,073	18.6	20.0	971
St. Olave	18.42	1.03963	24.5	25.5	1,244	24.9	25.9	1,257
St. Pancras	17.89	1.07043	20.0	21.4	1,044	20.3	21.7	1,053
St. Saviour	18.29	1.04702	25.1	26.3	1,283	25.1	26.3	1,277
Shoreditch	18.45	1.03794	22.7	23.6	1,151	23.8	24.7	1,199
Stoke Newington	17.85	1.07283	—	—	—	12.7	13.6	660
Strand	16.24	1.17919	25.2	29.7	1,449	22.7	26.8	1,301
Wandsworth	17.93	1.06804	14.5	15.5	756	15.3	16.3	791
Westminster	16.94	1.13046	21.6	24.4	1,190	22.3	25.2	1,223
Whitechapel	17.74	1.07948	22.7	24.5	1,195	21.1	22.8	1,107
Woolwich	16.99	1.12713	19.6	22.1	1,078	21.2	23.9	1,160

* These death-rates are fully corrected for institutions.

Battersea, Camberwell, St. Martin-in-the-Fields, Greenwich, Islington, Kensington, St. James Westminster, St. Marylebone, Fulham, Lambeth and Hammersmith.

From the special standpoint of city hygiene an interesting consideration arises. Were London made up solely of the townships included in group 1, or of group 2, or of group 3, its mortality would be represented by widely divergent figures. Broken up into these artificial groups, London might be described in the one case as perhaps the healthiest, in the other as one of the deadliest spots on earth.

The conclusion that a very large agglomeration can be managed on such hygienic lines as to yield a mortality far below the standard mortality of the country at large is an unexpected revelation. It is not altogether an unfair conclusion seeing that every district has some proportion of the poorer class included within it and its attached workhouses and infirmaries. Nevertheless it must be granted that in this respect the differences between districts are great.

The low aggregate mortality of a large proportion of the County

London suggests two interesting questions. Why should life in London be, on the test of mortality, so much safer than in many other districts? and may a similar standard of aggregate healthiness be inferred from the low mortality? We are made to recognize a greater value in those artificial agencies which have an improving hygienic effect, and particularly in the relative dryness, and in the more even warmth prevailing in the streets, boons partly due to the smoky and particle-laden atmosphere, to the radiation from continuous rows of houses and from an artificially warm soil, and to the greater evenness of temperature within its tall and continuous structures.

The deleterious contaminations of the atmosphere may be compensated by saving peculiarities analogous perhaps to the beneficial effect generally noticed by the asthmatic.

Much else might be said, and much yet remains to be made out, in connection with this important aspect of metropolitan hygiene.

THE RELATIVE INCREASE AND DECREASE IN THE DEATH-RATE
AT VARIOUS AGES, AND THE TOTAL GAIN OF LIFE.

The Death-rate for various Ages.—Mr. Shirley Murphy points out that the decrease found in 1899 as compared with the period 1881–1890 in the death-rate at “all ages” is referable to the period of life 0 to 25 for males, and 0 to 45 for females, the death-rate above 45 having increased, with the sole exception of female period of life 65. The increase in the death-rate from the age of 75 and upwards has been more marked in the female than in the male series.

The Total Gain of Life.—Comparing the period 1891–9 with that of 1881–90, the mean annual gain or loss of lives at various ages and the total gain of “life capital” is ingeniously brought out by utilizing the London Life Tables of 1881–90, and by comparing for each age the mortality which occurred with that which these tables would have led us to expect. The annual saving of 4,095 lives (M. 1,928, F. 2,167) represented a “life capital” of 172,763 years (M. 79,052, F. 93,711) owing to the high proportion of gain accruing from lives saved at an early age.

THE GENERAL AND THE INFANTILE DEATH-RATE IN THE
ADMINISTRATIVE COUNTY OF LONDON, COMPARED WITH THOSE
OF OTHER CAPITALS AND OF TOWNS IN THE UNITED KINGDOM.

The death-rates of other English towns with upwards of 200,000 inhabitants (census of 1891), corrected for age and sex distribution by multiplying the crude death-rates by the Registrar-General’s “factor for correction” (cf. Annual Report of the Registrar-General for 1899), are for 1899 higher than that of London except those of Bristol, Bradford, Hull and West Ham, and also higher for 1889–1898 with the exception of Bristol, Nottingham and West Ham, Hull having the same rate as London for this period.

The London death-rate for 1899 does not compare favourably with that of foreign capitals, being higher than any of them with

DEATH-RATE IN LONDON AND OTHER LARGE TOWNS.

Towns.	Estimated population middle of 1899.	Crude death-rate per 1,000 living.		Death-rate per 1,000 living (corrected for age and sex distribution).	
		1889-98	1899.	1889-98.	1899.
<i>London</i> . . .	4,546,752	19·6*	19·8*	20·9	21·1
<i>Manchester</i> . .	543,902	24·4	24·6	27·6	27·9
<i>Liverpool</i> . . .	634,212	25·6	26·4	28·1	29·0
<i>Birmingham</i> .	514,956	20·8	20·8	23·0	23·0
<i>Leeds</i> . . .	423,889	20·6	19·1	22·8	21·2
<i>Sheffield</i> . . .	361,169	21·3	22·2	23·7	24·7
<i>Bristol</i> . . .	320,911	18·5	18·2	19·2	18·9
<i>Nottingham</i> . .	239,384	18·6	20·0	20·0	21·5
<i>Bradford</i> . . .	236,241	19·4	18·4	22·2	21·1
<i>Hull</i> . . .	234,270	19·9	19·3	20·9	20·3
<i>Salford</i> . . .	218,244	24·3	23·8	27·3	26·8
<i>West Ham</i> . . .	300,241	17·2	16·7	18·6	18·0

the exception of Paris, Stockholm, St. Petersburg and Vienna, but for the period 1889 to 1898, only exceeds that of Brussels, Amsterdam, Copenhagen, and Stockholm.

DEATH-RATE IN LONDON AND OTHER CAPITALS.

Towns.	1889-98.	1899.	Towns.	1889-98.	1899.
<i>London</i> . . .	19·6*	19·8*	<i>St. Petersburg</i> .	29·2	25·2
<i>Paris</i> . . .	21·3	20·2	<i>Berlin</i> . . .	19·7	18·7
<i>Brussels</i> . . .	19·3	17·9	<i>Vienna</i> . . .	23·1	20·6
<i>Amsterdam</i> . .	19·2	15·3	<i>Rome</i> . . .	21·0	17·4
<i>Copenhagen</i> . .	19·5	19·2	<i>New York</i> . . .	22·8	18·4
<i>Stockholm</i> . .	18·7	20·0			

Infant Mortality contributes a large proportion in the general death-rate. The high mortality (167 per 1,000 births) reported in London for 1899 (only 157 for 1889-98) is exceeded by that of all the large towns in England with the exception of Bristol (148).

* Including deaths of Londoners in the Metropolitan Workhouses, Hospitals, and Lunatic Asylums, situated outside Registration London, but excluding deaths of persons not belonging to London occurring in the Highgate Small-pox Hospital, in the London Fever Hospital, in the Middlesex County Lunatic Asylum at Wandsworth, and in the Metropolitan Asylums Board Hospitals within Registration London.

DEATHS UNDER ONE YEAR OF AGE PER 1,000 BIRTHS IN LONDON AND OTHER LARGE TOWNS.

Towns.	1889-98.	1899.	Towns.	1889-98.	1899.
London . . .	157	167 ^{1/2}	Bristol . . .	148	158
Manchester . .	187	206	Nottingham. .	176	210
Liverpool . .	191	198	Bradford . . .	174	181
Birmingham .	184	191	Hull	177	175
Leeds	179	171	Salford	200	209
Sheffield . . .	183	194	West Ham . . .	157	197

THE DEATH-RATES FROM VARIOUS DISEASES IN 1899 IN THE ADMINISTRATIVE COUNTY OF LONDON, COMPARED WITH THOSE OF OTHER TOWNS.¹

The “**zymotic**” death-rate for 1899 in London (2·48 per 1,000 living) was less than in any of the large towns except Bristol and Bradford, while for 1889-98 the death-rate (2·73) only exceeded that of Leeds, Bristol, Nottingham, and Bradford.

The mortality from *small-pox* in London amounted to 3 deaths, while in none of the large towns except Hull (0·60) were sufficient deaths registered to give an appreciable death-rate. The death-rate from *measles* (0·47 per 1,000 living), although less than during the period 1889-98 (0·62), is greater than that registered in five of the large towns; but that from *scarlet fever* (0·09) is lower than that of most of the towns having more than 200,000 inhabitants.

The mortality from *diphtheria* (0·43 against 0·49 for 1889-98) is much in excess of that in all the large towns except Leeds and West Ham. The case-mortality per cent. as compared with that in 1898 has decreased from 14·8 to 14·2.

As regards the mortality from *whooping-cough*, which has decreased from 0·88 (1851-60) to 0·38 (1899), London occupies a central position in the list, but stands higher than any of the great capitals.

Typhus (14 cases notified and 2 deaths in 1899) has a vanishing death-rate of 0·000, against 0·055 in 1871-80.

* *Ibid.* p. 56, note.

¹ Extracted from *The Annual Report of the Medical Officer of Health of the Administrative County of London* (Mr. Shirley Murphy), London, 1899.

The mortality from *typhoid fever* (0·17 in 1899, against 0·24 in 1871–80) corresponds to a case-rate of 1·0, and to a case-mortality per cent. of 17·0.¹ In the Strand and Plumstead there were no deaths during this year. The City of London (0·43) showed the highest rate.

Diarrhœa and Dysentery.—The mortality from these (0·92 against 1·04 in 1861–70, and 0·57 in 1891) was 0·05 lower than for the previous year, although the summer temperature of 1899 was higher than in 1898. St. George Southwark had the highest rate (1·69), and the City of London the lowest (0·32). “As in 1889–98 the eastern group of districts suffered most heavily, and the northern least heavily from diarrhœa.”

Arranged under various ages the deaths in the Registration County numbered: for the period under 1 year, (3330): 1–5, (519); 5–20, (21); 20–40, (22); 40–60, (65); 60–80, (173); 80 and upwards, (66). The London death-rate from diarrhœa in 1899 was lower than in any of the large towns, and in the period 1889–98 was lower than that of any town except Bristol.

Diarrhœa and Infantile Diarrhœa.—The figures referring to this section of the mortality in London show that there has been no satisfactory progress during recent decennia. This is not peculiar to London. The same tale is told by the statistics of other cities—for instance of Glasgow. The following are Dr. J. B. Russell's statements:² The supply of pure water which has had a remarkable effect in diminishing the prevalence of diarrhœa in the adult, and therefore also the liability to the spread of cholera and of enteric fever, has not had that effect upon the mortality from infantile diarrhœa in Glasgow, as may be seen from Tables 9 and 10 (*loc. cit.* pp. 103 and 107). Other sanitary improvements which have reduced the diarrhœal death-rate of the adult have failed to benefit infantile diarrhœa, so that “the death-rate under the age of five years was in 1890–94, exactly what it was thirty years ago (1860–64)” ; and going back forty years we have the following “startling contrast between the age composition of one hundred deaths from diarrhœa at the beginning and at the end of the period” :—

¹ In all statistics it is an important reservation that typhoid is often acquired at one place and registered at another.

² *The Evolution of the Function of Public Health Administration*, etc. (Glasgow, William Hodge and Co., 1895), p. 60 *et seq.*

1850-54. 1890-94.

Under 1 year	31	55
1 year to 4 years	29	24
5 years and upwards	40	21

For this fatality no cause connected with sanitation can be found. The cause has to be sought elsewhere, and the writer may be allowed to state it as his opinion that a potent factor is the modern complication of infantile diet. The period of increasing prevalence is almost identical with that since the introduction of artificial and tinned foods for babies.

Deaths from *cholera* and *choleraic diarrhœa* were 153; of these 106 occurred among children under one year of age, but none were of the Asiatic kind.

Influenza, Bronchitis, and Pneumonia.—The tables relating to these diseases indicate a connection between their death-rates. In each case the number of deaths showed a marked increase over those of 1898. Although in the case of bronchitis the number of deaths was 1,008 below the counted annual average for the preceding ten years, the deaths from influenza and pneumonia showed an increase of 545 and 597 respectively over the annual average for the same period; this would seem to suggest a common meteorological determining cause.

Cancer.—The continued increase in the mortality from *cancer* is shown by the death-rates in the following periods:—

1851-60 . . .	·42	1894 . . .	·79
1861-70 . . .	·48	1895 . . .	·83
1871-80 . . .	·55	1896 . . .	·86
1881-90 . . .	·68	1897 . . .	·88
1891 . . .	·78	1898 . . .	·91
1892 . . .	·75	1899 . . .	·93
1893 . . .	·80		

The annual death-rate from cancer for the previous ten years averaging 3,669, the deaths registered in 1899 numbered 4,234.

THE DEATH-RATE FROM PHTHISIS.¹

The mortality from *phthisis* has on the whole maintained, in spite of the adverse factor of influenza, the low level to which

¹ The views expressed by Dr. James B. Russell, Senior Medical Officer for Health

it has steadily been descending. During the decade ending 1860 it had been 2·86 per 1,000 living; in the three following decades, 2·84, 2·51, and 2·09 respectively; and in 1895, 1·83. During the ensuing years the figures have been 1·73, 1·77, 1·77, and 1·88.

Under this heading of mortality great and suggestive differences are found between the several sanitary districts, as may be gathered from the figures in the following Table, which are extracted from Mr. Shirley Murphy's Report.¹

TABLE SHOWING THE DEATH-RATE FROM PHTHISIS IN THE VARIOUS SANITARY DISTRICTS OF LONDON FOR THE YEAR 1899.

Sanitary Districts.	Death-rate per 1,000 living.	Sanitary Districts.	Death-rate per 1,000 living.
Hampstead	·84	St. Marylebone	1·98
Stoke Newington	·88	St. Pancras	2·01
Lee	1·00	Shoreditch	2·10
Lewisham	1·07	St. James, Westminster	2·11
Paddington	1·15	Poplar	2·14
Wandsworth	1·21	Bermondsey	2·14
Kensington	1·31	City of London	2·19
St. George Hanover Square	1·36	Lincolns Inn	2·30
Plumstead	1·46	Clerkenwell	2·32
Hackney	1·50	Bethnal Green	2·36
Camberwell	1·53	Whitechapel	2·39
Greenwich	1·54	Woolwich	2·46
Battersea	1·59	St. George in the East	2·50
Islington	1·59	St. Olave	2·53
Hammersmith	1·72	Newington	2·63
Lambeth	1·75	Strand	2·70
Chelsea	1·79	Holborn	3·08
London (total deaths 8,291)	1·82	St. Giles	3·13
St. Martin in the Fields	1·82	Westminster	3·31
Mile End Old Town	1·82	St. Saviour, Southwark	3·44
Rotherhithe	1·83	St. George, Southwark	3·53
Fulham	1·83	St. Luke	3·53

for Glasgow, *loc. cit.*, page 115, in connection with the diminution in the mortality from phthisis in Glasgow are eminently applicable to London. A very large share in this improvement must be credited to the limitation of infectious diseases, which too often undermine the constitution and prepare the soil for the bacillus. Another direct and powerful predisposing cause of phthisis, and one for the prevention of which enough has not yet been achieved, is the universal catarrh of the lungs which is provoked by our damp, smoke-laden atmosphere.

¹ *Loc. cit.* (see note 1 on p. 57).

In the group of the eastern districts and in that of the central districts the death-rate (2·19 and 2·75 respectively) was in excess of that of London. In the northern group (1·64), in the western group (1·65), and in the southern group (1·74) the death-rate was below that of London.

MALARIA.

Typhus or jail fever, as already pointed out, has now disappeared. Its habitation was in the squalid, overcrowded alleys and courts of Old London. Typhoid and small-pox are becoming a rarity, and the other severe zymotics have only occasional outbreaks. Diphtheria alone prevails with unabated force. Local climates or soils hardly influenced the prevalence of these severe forms of disease; and this was governed mainly by the density of the population and its pauperism.

The one locally endemic disease special to London was *malaria*, and a brief reference to it is not foreign to the climatological and medical scope of this Report.

Even down to recent times the sporadic occurrence of ague has been noted by some of the London physicians, and although ague does not appear in the list of the London diseases recorded by the Registrar-General, there are to the present day those who believe in a London malaria.

A knowledge that this impression somewhere prevailed led the writer whilst preparing this Report to investigate the question, and an inquiry was set on foot, the results of which are embodied in a Paper "On the Decrease of Ague and Aguish Affections in London,"¹ read before the British Balneological and Climatological Society, on December 9, 1896. The following conclusions were drawn as to the prevalence of ague in London in the past and at present:—

(1) "The prevalence, prior to this century, of an ague, sometimes of a severe type, in an endemic form in London admits of little doubt. We are the more inclined to accept the diagnosis of former physicians as having been in the main correct, as London has since then furnished undoubted though isolated cases of the disease.

¹ Cf. *The Journal of Balneology and Climatology*, Vol. I. Part i. pp. 24—48. January 1897.

(2) "The severity and the frequency of the affection, previously subject to fluctuations, began permanently to subside before the end of the eighteenth century, and continued to decrease at a considerable rate during the first half of the present one.

(3) "During the last thirty years ague has been dying out, not only in London, where, if it is seen at all, it can hardly be recognized, but even in the most aguish country districts.

(4) "The origin of the agues observed in Old London must have been in great measure local. As more and more of the unhealthy soil was built over, the remaining London ague must have crept in from the marshes then lying at the gates of this city. And again, as the urban ague was decreasing more and more, suburban and country ague poured into London with increasing abundance, owing to the growing influx of population. Thus for a time both forms must have existed side by side, though an increasing share belonged to the imported variety.

(5) "The question as to the occurrence within recent times of cases originating in London, must, from the facts which have been reported, be answered in the affirmative. The strong traditions still remembered at some of our hospitals can only be explained by the former prevalence of this mode of origin: and their correctness is supported by the sporadic cases of recent date which have been mentioned above.

(6) "It is an important and most practical question to decide whether aguish affections of minor degree may still be lingering unsuspected in some of our low-lying districts, and whether the originally malarial character of these localities may in any appreciable degree modify the type of some other affections, and particularly of typhoid fever and of influenza when they occur.

(7) "The persistency and the situation of 'ague spots' in London is another question which the inquiries cannot be said to have definitely settled. Probably we shall hear less and less of them. Those which have been referred to are included within the modern additions to the metropolitan area. The same process might have repeated itself in the case of any future extensions of the metropolis, but for the almost complete suppression of ague in the neighbourhood of London.

"We are justified in drawing the final conclusion that London ague may be relegated to the small but growing class of extinct

diseases, and in conceiving a hope that the same fate may overtake malaria in the United Kingdom."

THE GENERAL MORTALITY AND THE MORTALITY FROM SEVERAL DISEASES IN THE COUNTIES OF LONDON AND MIDDLESEX COMPARED WITH THE MORTALITY FROM THE SAME CAUSES IN ENGLAND AND WALES FOR THE DECADE 1881—1890 (PER MILLION PERSONS LIVING). FROM THE *Supplement to the 55th Annual Report of the Registrar-General* (pp. c—cii).

The comparative returns from the counties of London, Middlesex, Surrey, Sussex and Kent relating to the year 1891 will be found in the first volume of *The Climates and Baths of Great Britain*, pp. 268 *et seq.* Since then we have been provided by the Registrar-General with the returns for the period 1881—1890, which in various directions differ from the results obtained for the single year stated. The conclusions which had been based upon the latter will therefore need revision.

I.

MORTALITY FROM ALL CAUSES.¹

Order of Mortality:—

Surrey	15,293	
Sussex	15,657	
Middlesex	16,131	
Kent	16,572	
Essex	16,818	
England and Wales		19,080
London		20,308

II.

CANCER.¹

Order of Mortality:—

Essex	543	
Middlesex	547	
England and Wales		589
Surrey	603	
Kent	616	
London		683
Sussex	727	

¹ For further consideration of this subject see also pp. 132—136.

III.

PHTHISIS.¹*Order of Mortality:—*

Middlesex	.	.	.	.	.	1376	
Essex	.	.	.	.	.	1431	
Kent	.	.	.	.	.	1511	
Surrey	.	.	.	.	.	1574	
Sussex	.	.	.	.	.	1662	
England and Wales	.	.	.	.	.		1724
London	.	.	.	.	.		2078

IV.

DISEASE OF THE RESPIRATORY SYSTEM.

Order of Mortality:—

Surrey	.	.	.	.	.	2506	
Sussex	.	.	.	.	.	2529	
Kent	.	.	.	.	.	2720	
Middlesex	.	.	.	.	.	2924	
Essex	.	.	.	.	.	3064	
England and Wales	.	.	.	.	.		3729
London	.	.	.	.	.		4286

VII.

DISEASES OF THE URINARY SYSTEM.

Order of Mortality:—

Essex	.	.	.	.	.	346	
Middlesex	.	.	.	.	.	367	
Surrey	.	.	.	.	.	412	
Kent	.	.	.	.	.	429	
England and Wales	.	.	.	.	.		435
Sussex	.	.	.	.	.	456	
London	.	.	.	.	.		504

DISEASES OF THE CIRCULATORY SYSTEM.

Order of Mortality:—

Middlesex	.	.	.	.	.	1322	
Essex	.	.	.	.	.	1426	
London	.	.	.	.	.		1491
Surrey	.	.	.	.	.	1517	
England and Wales	.	.	.	.	.		1576
Sussex	.	.	.	.	.	1594	
Kent	.	.	.	.	.	1626	

DISEASES OF THE DIGESTIVE SYSTEM.

Order of Mortality:—

Essex	.	.	.	.	.	905	
Surrey	.	.	.	.	.	920	
Middlesex	.	.	.	.	.	980	
Sussex	.	.	.	.	.	990	
Kent	.	.	.	.	.	1016	
England and Wales	.	.	.	.	.		1104
London	.	.	.	.	.		1118

¹ For further consideration of this subject see also pp. 134-135.

DISEASE OF THE NERVOUS SYSTEM.

Order of Mortality:—

Sussex	1982	
Middlesex	2265	
Essex	2271	
Kent	2280	
London		2326
Surrey	2460	
England and Wales		2592

V.

THE COMPARATIVE HEALTH VALUE OF LONDON AND OF
THE SUBURBS FOR RESIDENCE.

GREAT contrasts hardly belong to so limited a region. Essentially the same weather prevails over all its parts, with identical variations. Yet some of the elements of climate, and particularly the meteorological elements, show within Greater London appreciable local differences, and the varying local incidence of rainfall, of mist, of fogs, and of atmospheric impurities, establishes within it perceptible inequalities.

LONDON COMPARED WITH THE SUBURBS.

London as a Residence.

Many people prefer to dwell in the centre of London, but few select it on account of their health. The "town habit" once acquired is not easily satisfied with the limited resources and milder excitement of suburban life. Convenience both for work and for pleasure, and the quicker pulse of a gregarious life are at the bottom of this devotion to London. With advancing years health is more and more dependent upon regularity and evenness of stimulation. Old Londoners may for this reason feel themselves nowhere so well as within a shilling fare of Charing Cross. And again, for a large number residence in London is preferable to the slavery and the fatigue of a daily journey by train.

A few ailments may benefit by a town atmosphere; but in only one of them does this advantage amount to a positive remedy. An attack of nervous asthma is sometimes cut short by the patient

removing into the centre of London from the air of the country, and conceivably other nervous disorders may also be benefited. In the case of rheumatism London cannot lay claim to any remedial virtue: but its modern physical conditions suit the rheumatic group better than those which prevail in a growing suburb, and it might even be held that they are prophylactic.

The general healthiness of London has been dwelt upon. As gauged by the death-rate, it compares favourably with the healthiness of England and Wales. This is due to the exceptionally low mortality of some of its districts rather than to a uniformity of excellence among them. A good average of life, and fairly numerous instances of longevity, are also to be found in London.

On closer analysis the climatic peculiarities of London will be found to be evenly balanced between good and evil. The health advantages of inner London for residential purposes are its relative evenness and mildness. With all its faults, its climate is a protective climate. London enjoys less exposure, greater warmth and less humidity than the outlying country, and these advantages might be missed by some delicate persons in giving up their residence in London for a suburban one.

Exposure is materially lessened. The winds that blow through the metropolis are for it a condition of existence, but the further they penetrate the more their sharpness is tempered. And to this mitigation must be added the actual shelter often to be obtained by crossing a street or by turning a corner. A short country journey on a windy day brings home to the Londoner this privilege of town life.

Greater and more even warmth is also a tangible advantage. Its causes are sufficiently obvious. More heat is produced and less is lost where houses are massed together. The share taken in the supply of heat by warm houses is likely to increase in proportion to the greater height to which they are built, and with the central heating system, which also tends to raise the temperature of the soil. Again, less heat is lost by radiation. The protection given by the sheet of smoke which usually spreads over London becomes even greater when smoke is thickened by fog. Radiation is much reduced, and a marked difference often results between the town temperature and that of the surrounding country. Moreover, of recent years the radiating power of the surface itself has

been diminished by the extensive adoption of wood pavement, the imperfect conducting power of which tends to further delay the loss of that heat which travels through the soil from the adjoining heat supplies.

Far greater than any other advantage is the relative dryness now prevailing in London. Desiccation of the London soil in some of its central parts has reached a high pitch. Except in the riverside or low-lying gravel areas the subsoil is almost free from moisture, and the waterproof pavement with which roads are covered, as well as the diminution in the area of private gardens, many of which are asphalted over, reduce to a minimum the moisture due to rainfall.

On all these counts, in spite of an obvious inferiority to the suburbs as regards quality and purity of air, London has its redeeming features, and its remarkable standard of health is satisfactorily explained.

The Various Districts in London.—It would be quite impossible to trace back from the local returns of the Registrar-General or from our own impressions and feelings as we explore the various districts of London those distinctions arising from configuration and soil which must have been obvious before London was built. Alone the practical test of residing for a while in a district might perhaps reveal, in the case of susceptible persons, some remnant of the influences in question. As a fact most individual peculiarities of localities, their worst features as well as their attractions, disappear under the growth of a town, and modern sanitary building brings up to a respectable level of healthiness localities which otherwise would have little to recommend them. As structures cover the open space dampness is kept under, the force of wind is broken, and absence of slope is artificially overcome for purposes of drainage and of water supply. In London these equalizing influences have had the result that many districts, particularly the central ones, may be grouped together as enjoying approximately the same health value.

Health may be preserved and healthy families may be brought up in any part of London, and it is obvious that the conditions of life as regards food, raiment and shelter, and particularly as regards agglomeration, influence the death-rate more than do climate or soil.

Whilst Londoners have more reason to complain of their atmosphere than of their soil, the best air is generally found over the best situations and strata, and in our comparative study it is well therefore that we should note that the geology as well as the elevation of localities are essential guides. For these data the valuable work of Mr. Woodward¹ has been laid under contribution; and the districts, both urban and suburban, with their altitude have been grouped under headings of the various geological formations.

Some of the least desirable and the lowest-lying parts of London are situated south of the great bend of the Thames between Deptford and Battersea, yet in this region as in the case of the poorer districts north of the Thames, those of Poplar, Bow, Hackney, etc., the width of the main thoroughfares makes up for the crowded state of some of the smaller streets.

Further south we pass into a suburban residential region, that of **Brixton**, **Herne Hill**, **Lower Norwood**, etc., the only fault of which is a slight dampness arising from a clay soil. Here, however, the levels rise markedly, and the undulating character of this clay area affords a large choice of favourable sloping situations. Moreover the localities mentioned are rapidly becoming covered instead of dotted with habitations.

East and west we find the two great suburban health districts south of the Thames, —the **Blackheath** and **Sydenham** group and the **Wimbledon** group, of which more might be said did space permit.

Continuous with the Lambeth gravel is that of Battersea and Clapham.

Battersea is now viewed with less prejudice than formerly, and is utilized for residence by the upper middle class. The tall mansions recently erected afford an opportunity of living at a height even in a low-lying district, and for those tenantry the upper flats in Battersea no better air could possibly be wished. On the other hand the poorer population residing in inferior dwellings on damp gravel and loam, are exposed to obvious risks from rheumatism, although this evil has been much lessened by the embanking of the Thames.

Clapham is a much more salubrious suburb, and its fine common

¹ *Loc. cit.* (see note on p. 2).

which, like that of **Wandsworth**, is regarded as bracing, has long been the resort of a large set of suburban dwellers and a selected area for schools. The higher level of the gravel makes it suffer less from the damp arising from the River.

Wandsworth has a low-lying part along the mouth of the Wandle, as well as the higher ground of the common. The indications are here obvious. A great deal of this district may be regarded as thoroughly healthy in spite of its neighbourhood to the River.

On the north side of the Thames, **Fulham** and **Hammersmith** are more noted for their low altitude, their liability to floods and their relative dampness. All this region as well as Chelsea, Brompton and part of Kensington is on gravel, and but for the free percolation of water from the Thames, would be dry and of sound surface for building. Market-gardens for a long time occupied the Fulham fields, where loam also occurs in patches: but they have now disappeared, and almost the entire district is covered with houses and has lost all outward evidence of the dampness of its subsoil.

A riverside dwelling and a view up and down the misty banks of the Thames are luxuries to the artist and to the man of letters, which can now be indulged in more safely than ever before. A broad embankment separates the houses from the water's edge: and in the districts of Westminster and of the Strand, the gigantic hotels stand still further back behind public ornamental gardens. In **Chelsea** as in Battersea the height of the mansions facing the river ensures to the upper dwellers perfect freedom from dampness of air,—conditions entirely different from the older style, when the damp gained access to the cellars of tenements occupying the low banks of Lambeth, Wandsworth, Putney, and Fulham. These localities still need to be avoided by rheumatic and phthisical patients, but it must be said for the riverside sites that an element of healthiness is introduced by the freshness of the air and its constant renewal along the tidal river Thames. The drawbacks of temperature and low-lying soil are not therefore so prominent as in many an enclosed and ill-ventilated clay valley.

The same saving clause applies to all the other riverside flats, whether their soil be gravel or alluvium. There is no lack of a bracing quality of the air.

Shepherd's Bush forms part of a large area of brick-earth, and is regarded by some sufferers from rheumatism as a specially favourable residence: and reason may be shown for this, the gravel upon which it rests perhaps keeping the loam drier than it would be in the purely clay district. The part of **Notting Hill** which lies on gravel is one of the most pleasant and healthy residential districts in London, and its many advantages caused it to be selected at an early date for suburban residence. Little of it now remains open to fresh building.

Kensington is mainly built on the same gravel, and West Kensington on brick-earth. The Kensington district is so large that we may trace in it various qualities. The northern part or Notting Hill is bracing: the Western is analogous to Shepherd's Bush, whilst South Kensington is like itself only. Temperate and soft almost to a fault its climate is admittedly relaxing, and this is partly due to its damp gravel soil and greatly also to its situation, for it is deprived by the shelter and the dampness of the Park of the bracing influences from the north.

Paddington is also on Valley Gravel, and is regarded as healthy.

Maida Vale, Maida Hill and **Kilburn** belong to the large clay region which extends north and north-east from the latitude of Marylebone Road. Although flatness prevails, the worst evils of a clay soil are not conspicuous. The inhabitants of Maida Vale repudiate the idea that any dampness arises in the neighbourhood of the Canal, which is the picturesque feature of their district.

Regent's Park itself presents the features of a clay soil without any disguise. That it is damp is beyond dispute,—mists readily forming over it which convey dampness to its surroundings. This is also the case with Hyde Park, although there the soil is gravel and there is less permanent dampness.

Kentish Town, Camden Town, Islington and King's Cross are all salubrious in spite of their clay soil. Their general healthiness may even be due to the clay by reason of its association with the advantages of a good elevation.

Stoke Newington is also on clay with some parts on brick-earth. The elevation is relatively good in spite of its proximity to the Lea valley.

Passing along the Lea valley we find gravel underlying the districts of Homerton, Hackney, Bow and Poplar, none of which are likely to attract middle-class residents.

This gravel, which is interrupted by the alluvial tract of the Lea but extends into Essex as far as Ockenden, ranges without a break westwards to Windsor, etc., across the central parts of London. It is only varied by a few irregular southward prolongations from the clay area farther north, the chief of these being that following the line of Farringdon Street and ending in the neighbourhood of Farringdon Station.

The whole of this extensive gravel area is healthy, and as well suited for residence as any central city district could be.

The Indications and Contra-Indications in Health and in Disease in the choice of a Town District.—On reviewing the whole subject, the only districts to which exception could be taken are the southern group from Bermondsey to Lambeth, where the disadvantage of a porous soil and a low level aggravate the depressing influences of a central metropolitan position; and those of the East End, where the elevation is also poor, but the chief fault is the over-population of some of the inhabited areas.

For those in health any of the remaining districts would afford salubrious residences, but for invalids there is plenty of scope for a selection between them.

Rheumatic subjects would do well to avoid the immediate vicinity of the river, less perhaps on account of any dampness of the air, although this is usually draughty and sometimes chilly, than on account of the possible dampness of houses and of the soil. Very high situations again may prove too cold. The immediate neighbourhood of the parks in winter is not good. Moderate elevation on a gravel area, as at Clapham, Wandsworth, Brompton, some parts of Kensington, Paddington, etc., is the best combination to be found: or again, residence on brick-earth, as at Shepherd's Bush, where the brick-earth is itself on gravel.

Lastly, a clay soil may be allowed where the undulations keep the houses dry as well as protected. Special situations of this kind are to be found in various districts both south and north of the Thames.

Sufferers from *bronchial* delicacy will avoid the more exposed

and bracing districts for those which are mild and protected. In the West End, South Kensington and Brompton will be preferred, for their climate is well known to be sheltered and temperate.

Two of the hospitals where *phthisis* is now treated in London, represent opposite views, the old and the new, as to its climatic management. The Brompton Hospital is built in a moderately warm and mild atmosphere: the North-Western Hospital on a relatively bracing site near Hampstead Heath. The present tendency is decidedly in favour of the more bracing treatment, and whilst the advantages of the Brompton Hospital remain, the south-western district may probably not be recommended as specially suited for the residence of consumptives outside the hospital. The claim which was originally set up for the Brompton site in connection with the alleged virtue of a gravel soil would have little value compared with the advantages of purer air, such as that of Blackheath, Upper Norwood, or of Sydenham, Hampstead or Highgate, in spite of the fact that at some of these places the subsoil is of clay.

The Health Resorts within the County of London, if such a designation may be attached to situations of exceptional excellence from the health standpoint, deserve a passing mention. They are all distinguished by considerable elevation and very bracing air, and they are conveniently distributed at various ends of the metropolis, at Blackheath, Sydenham, Upper Norwood, Putney, Hampstead, and partly beyond the County boundaries, at Highgate and Crouch End.

Beyond the boundaries of the County, rheumatic as well as phthisical patients should be advised to seek the higher gravel areas and shun those adjoining rivers as well as the alluvial tracts along the latter.

Rheumatism does well at Blackheath on sandy soil, but Wimbledon at the opposite end of London with its clay soil interspersed with patches of gravel suits it badly, and Chislehurst in some of its districts is also disappointing.

Pulmonary catarrh, bronchitis and kidney disease are best off in pine districts with sandy soil, such as Weybridge and the Woking region.

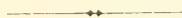
Phthisis and all conditions of debility are best suited by the dry

soil of the Downs, or of the chalky regions at the South-East of London, where sheltered and relatively warm sunny situations may readily be picked out.

VI.

CLASSIFIED INDEX OF LOCAL SURFACE GEOLOGIES AND ALTITUDES.

As the chapter describing the Suburban Climates is withheld for want of space, the following classifications of the chief towns, villages, and localities of Greater London, arranged under sub-headings of the soils which underlie each place, may prove of practical service for ready reference (for map see p. 5).



INDEX OF SURFACE GEOLOGIES AND ALTITUDES.

KEY TO THE INDEX.

The *figures* following each name give the altitude in feet above Ordnance datum, the *letters* represent the district or suburban area in which they are situated. The towns, etc., printed in ordinary type, belong to Greater London outside the county; those in *italics* are within the county of London.

The *letters in brackets* which follow the names of places refer to the geological formations there represented, as follows:—

A. Alluvium (Marshland).	L. London Clay.
Bel. Boulder Clay.	Lg. Lower Greensand.
Bg. Bagshot Beds (chiefly sand).	Lm. Loam (brick-earth).
Bl. Blackheath Beds (gravel).	T. Thanet Sand.
C. Chalk.	Vg. Valley Gravel.
G. Gravel and Sand of higher grounds.	W. Woolwich and Reading Beds (mixed gravel, sand, and clay).

(a) May rest on gravel, or direct on London clay, from which it differs in being less dense, owing to the collection of stones, fossils, chalk, and flint pebbles from various strata.

(b) For healthiness, chalk is an admirable building surface, but it needs testing as to the absence of pipes.

(c) This deposit is between 5 and 45 feet in thickness, and usually lies over water-logged gravel. This means dampness when the alluvium is thin or porous.

* Floods occur all along these tracts.

‡ Floods are apt to occur in all these districts.

§ Floods are liable to occur in these districts.

(d) Very well suited for building and for residence.

(e) Highly eligible for residential purposes.

(f) Thoroughly dry and healthy.

(g) This formation is regarded as favourable for building, in spite of the occurrence of clay within it, by reason of a large proportion of porous soil.

(h) This soil is impervious, but more absorbent than clay, allowing surface water to get away more readily on the level. In general it is suitable for residence.

..

THE INDEX.

(COMPARE ALSO THE MAP, PAGE 5.)

Boulder Clay (a) (a stony and chalky clay and loam).

Cheshunt Common, N.

Chigwell Row, N.E.

Entfield Chase, N.

Epping, N.E. (L.)

Finchley, 280-300, N. (G. Lm.)

Highwood, Essex, 283, N.E. (Bg. L. Lm.)

Lambourn, 200, N.E. (Bg. G. L.)

Muswell Hill, 341, N. (G.)

Theydon Bois, 211, N.E. (L.)

.. Gernon, 200, N.E. (L.)

.. Mount, 255, N.E. (G. L.)

Whetstone, near, 312, N.

Wood Park, Finchley, 250-300, N. (G. L.)

Chalk (b) (mainly of soft and more or less permeable white limestone, etc.).

Addington, Surrey, 270, S. (Vg.)

Alderham, 254, N.W. (G.)

Ashted, 229, S.W. (T. W.)

Banstead, 507, S.W.

Beddington, 120, S. (T.)

Carshalton, 150, S. (T. Vg.)

Charlton, 150, S.E. (Bl. T. W.)

Cheam, 180, S.W. (T. W.)

Chislehurst, 300, S.E. (Bl. T. W.)

Chorley Wood, 300-376. (G.)

Cray, North, 187, S.E. (T. W.)

.. Mary's, 180, S.E. (T. Vg.)

Cray, Paul's, 200, S.E. (T. Vg.)

Crayford, 100, S.E. (Lm. T. Vg.)

Croydon, 160-200, S. (Bl. W. Vg.)

Dartford, 50, S.E. (Vg.)

Epsom, 200, S.W. (W. Vg.)

Erith, 25-30, S.E. (T. Vg.)

Eynesford, 180, S.E. (Vg.)

Ewell, 150, S.W. (T. W.)

Farningham, 120, S.E. (A. Vg.)

Harefield, 280, N.W. (G. L. W.)

Keston, 262, S.E. (Bl. T. W.)

Letchmore Heath, 280, N.W. (W.)

Lewisham, near, 30-90, S.E.

London Colney, 225, N.W. (G.)

Mimms, North, 245, N. (Vg.)

.. South, 300, N. (G. L. W.)

Plumstead, north of, 50-100, S.E.

Sundridge Park, 200, S.E. (Bl. T. W.)

Sutton, 115-200, S. (T. Vg. W.)

Swanley, 160, S.E. (T.)

Waddon, 150, S. (T.)

Wallington, 120, S.W. (T.)

Westcombe Park, 50-140, S.E. (Bl. T. W.)

Wickham Court, 300, S.E. (T.)

Woolwich, 20-150, S.E. (Bl. T. W.)

Alluvium or Marshland (c) (Silt, clay, peat with occasional mail or gravel).

Beckton, 7, E.

Belvedere Erith, 75, S.E. (Bl. T. W.)

Bermondsey, 10, S.

Alluvium or Marshland

- Bexley, 50, S.E. (Vg.)
- Blackwall*, 20. (E.)
- Brent Valley N.W. and W. (Greenford to Hanwell.)
- Canning Town, O.E.
- + Coln Valley, W. and N.W. (Staines to Watford.)
- Crossness, S.E.
- Deptford*, 20, S.E. (Vg.)
- Earlsfield, Wandsworth, 32, S.W. (L. Vg.)
- Farmingham (see C.)
- Greenwich, North*, S.E.
- Hackney Wick*, 22. (L. Vg.)
- Isle of Dogs*, 10-20, E.
- Lambeth*, 14-30, S. (Vg.)
- + Lea Valley, N. and N.E. (Enfield to Plaistow.)
- Pinner*, 20, S.W. (Vg.)
- Pinner Marshes*, S.E.
- Rotherhithe*, 10, S.E.
- St. James' Park*, 15. (Vg.)
- Silvertown, 8, E.
- Southwark*, 20.
- Summer's Town, Tooting*, 33, S. (L. Vg.)
- Waltham* (Vg.)
- Westminster*, 16. (Vg.)
- Woolwich, North*, 8, E.

Valley Gravel and Sand (flint with quartz and quartzite).

- Acton, 40-90, W. (Lm. L.)
- Adlington (see C.)
- Addiscombe, 200, S. (Bl.)
- Ashford, 45, W.
- Batham*, 85, S. (L. Lm.)
- Barking, 20, E.
- + Barnes, 15-30, S.W. (Lm.)
- Barnsbury*, 130, N.
- Battersea*, 15. (Lm.)
- Bayswater*, 80. (L. Lm.)
- Beech Hill Park, Enfield, 140, N. (L.)
- Betchworth. (Lg. Lm. Wd.)
- Bexley (see A.)
- Bidfont, East, 60, W.
- .. West, 70, W.
- Bloomsbury*, 83. (Lm.)
- Bow*, 36, E.
- Brentford, 30, W. (Lm.)
- Brixton*, 20-177, S. (L.)
- Bromley Row*, 20, E.
- Brompton*, 28, S.W.
- Bruce Grove, Tottenham, 44, N. (L.)
- Camberwell*, 15-30, S.
- Cambridge Heath*, 50, E.
- Camden Hill*, 100, N. (L. Lm.)
- Castle Hill and Castle Bar, Ealing, 120-167, W. (L.)

- Catford Bridge*, 50-70, S.E. (L.)
- Charing Cross*, 25.
- Chelsea*, 15-30.
- Cheshunt, 85, N.
- Chigwell, 209, N.E. (L.)
- + Chiswick, 24, W. (Lm.)
- Clapham*, 50-100, S.W. (L.)
- Clapton*, 80-100, N.E. (Lm.)
- Cobham, 75, S.W.
- Colney Hatch, 215, N. (L.)
- Cowley Uxbridge, 100, W. (Lm.)
- Crayford (see C.)
- Cricklewood, 166, N. (L.)
- Croydon (see C.)
- Deptford* (see A.)
- Drayton Park, Ealing, 85-110, N.W.
- Ealing, 100, N.W. (Lm.)
- Earlsfield (see A.)
- Edmonton, 50, N. (Lm.)
- Egham, 50-150. (L.)
- Elmer's-end, Beckenham, 110, S.E. (Bl. Lm.)
- Elthorne Hanwell, 60-100, N.W. (L.)
- Enfield, 108, N. (Lm.)
- Enfield Highway, 66, N. (Lm.)
- Eynesford (see C.)
- Farmingham (see C.)
- Feltham, 50, W.
- Foots Cray, 144, S.E.
- Forest Gate, 39, E.
- Forty Hill, 110.
- Fulham*, 20.
- Fulwell, Twickenham, 50, W.
- Green Park*, 50. (L.)
- Greenford, 70, W. (L.)
- Greenwich*, 14-150, S.E. (Bl. T. W.)
- Grove Park, Chiswick, 20, W.
- Gunnarsbury, 69, W.
- Hackbridge, 80, S.W.
- Hackney*, 40-56, N.E.
- Hackney Wick* (see A.)
- Hainault Forest, 100, N.E. (L.)
- Ham, 25, S.W.
- .. East, 15, E.
- .. West, 13-20, E.
- Hammersmith*, 20, W. (Lm.)
- Hampton, 40, W.
- .. Court, 30, W.
- .. Wick, 30, W.
- Hanwell, 80, N.W.
- Harlington, 85, N.W.
- Hayes, Kent, 210, S.E. (Bl.)
- .. Middlesex, 135, N.W. (Lm.)
- Hersham, 51, S.W.
- Heston, 100, W. (Lm.)
- Highams Park, 50, N.E. (L.)
- Highbury*, 80-154, N. (L. Lm.)
- Highwood Hill (see G.)
- Hillingdon, 188, W.

Valley Gravel and Sand

- Hither Green, 100, S.E. (L. W.)
 Hounslow, 60-70, W.
Hurlingham Park, 18.
Hyde Park, 50-80, (L.)
 Ilford, Great, 42, E. (Lm.)
 Isleworth, 27, W.
 Islington, 70-150, N. (L.)
 Kempton Park, 40, S.W.
Kewington, 16, S.
Kensington, 25-90, W.
 † Kew, 20, W.
 Kingsbury, 150-200, (L.)
Kingsland, 60, N.E.
 Kingston-on-Thames, 33, S.W.
 Knightsbridge, 60, (L.)
 Knotts Green, Walthamstow, 82, N.E. (L.)
Lambeth (see A).
Lavender Hill, 57, S.W.
Lewisham, 30-90, S.E. (L. W.)
 Leybourne, 84, (Lg.)
 Leyton, 33-50, N.E.
 Leytonstone, 70, N.E. (L.)
Limehouse, 29, E.
 Little Ilford, 30, E.
London Fields, 62, N.E.
 Loughborough Park, 50, S.
 Low Leyton, 30, N.E.
 Manor Park, Essex, 35, E.
Marylebone, 80-90.
Mayfair, 50-90.
 Merton, 45, S.W. (L.)
Mile End, 40, E.
 Mill Hill Park, Acton, 80, N.W.
 Minims, North (see C).
 „ South (see C).
 Mitcham, 70, S.W.
 † Molesey, 33, S.W.
 Moorfields, 60.
 Mortlake, 25, S.W.
New Cross, 46, S.E. (L. W.)
Newington Butts, 11, S.
 „ *Green*, 90, N. (Lm.)
 Norbury, Streatham, 130, S. (L.)
Notting Hill, 97, N.W. (L.)
 Ockendon, North, 100, E.
 „ South, 79, E.
Old Ford, 42, N.E. (Lm.)
 Osterley Park, 86, W. (Lm.)
Paddington, 100, N.W.
 Palmer's Green, 133, N. (L.)
Parson's Green, 14, W. (L. M.)
Peckham, 15-50, S. (Lm. W.)
 Perivale, 70.
 Petersham, 23, S.W.
Pimlico (see A).
 Pinner, 160-200, N.W. (L. W.)
 Plaistow, 30, E.
 Ponders End, 60, N.
Poplar, 22, E.
Putney, 30-170, S.W. (L.)
Rutcliff, 32, E.
 Ravensbourne Park, Calford, 100, S.E. (L.)
 ‡ Richmond, 25-100, S.W. (L.)
 Roehampton, 150, S.W. (L.)
 Romford, 58, E. (L.)
Rushey Green, Calford, 58, S.E.
St. James' Park (see A).
St. John's, Lewisham, 70, S.E. (W.)
 St. Margaret's, Twickenham, 20, S.W.
 St. Mary Cray (see C).
 St. Paul's Cray (see C).
 Selhurst, Croydon, 170, S. (Bl. L.)
 Shacklewell, 82, (L.)
Shadwell, 20, E.
 Sheen, East, 59, S.W.
Shepherd's Bush, 24, W. (Lm.)
 Shepperton, 40, W.
 Shortlands, 150-200, S.E. (Bl. T. W.)
Smithfield, 58.
 Snaresbrook, 76, N.E. (L.)
 Southall, 100, W. (Lm.)
 South Beckenham, 100, S.E. (L.)
 Southfields, 100, S.W. (L.)
Spitalfields, 50.
 Springfield Park, Acton, 100, N.W.
 † Staines, 50, W.
 Stamford Hill, 100, N. (L.)
 Stanwell, 70.
Stepney, 32, E. (Lm.)
Stockwell, 50, S.W.
 Stoke D'Abernon, 113, S.W. (L.)
 Strand on the Green, Chiswick, 23, W. (Lm.)
 Stratford, 25, E.
 Strawberry Hill, 39, S.W.
Streatham, 100-184, S. (L.)
Summer's Town, Tooting (see A).
 Sunbury, 37, W.
 Surbiton, 100, S.W. (L.)
 Sutton (see C).
 Syon Park, Isleworth, 22, W.
 Teddington, 30, W.
 § Thames Ditton, 30, S.W.
 Thornton Heath, Croydon, 150, S.
Tooting, 50-100, S. (L.)
 Tottenham, 20-50, N. (L.)
 Twickenham, 30, W.
 Upton, 33, E.
 „ Park, 33, E.
 Uxbridge, 100-175, W.
Vauxhall (see A).
Victoria Park, 46, N.E.
Walbrook (see A).
Waltham Green, 16, W. (Lm.)
 Waltham Abbey, 70, N.E.

Valley Gravel and Sand

Waltham Cross, 70, N.
Walthamstow, 20-80, N.E. (L.)
Walton-on-Thames, 50, S.W.
Walworth, 14, S.
Wandsworth, 20-70, S.W. (L. Lm.)
Wanstead, 70, N.E. (L.)
West Drayton, 25, W. (Lm.)
Westminster (see A).
Whitechapel, 47.
§ Wimbledon, 180, S.W. (L.)
Woodgrange Park, Ilford, 35, E.
Yiewsley, 100, W. (Lm.)

London Clay (generally of a stiff brown character).

Abney Park, 85. (Lm.)
Acton (see Vg).
Alexandra Park, 300, N.
Alperton, 100, N.W.
Anerley, 200, S.
Balham (see Vg).
Barnet, 429, N. (G.)
,, East, 158, N.
,, New, 200, N.
Bayswater (see Vg).
Belsize Park, 200, N.W.
Bentley Hill, 320, S.
Blackfriars (see Vg).
Boreham Wood, 300.
Bounds Green, Colney Hatch, 142, N.
Bowes Park, 87, N.
Brixton (see Vg).
Brockley, 100.
Brockwell Park, 100, S.E. (W.)
Bromdesbury, 160-200, N.W.
Brownswood Park, 85.
Bruce Grove, Tottenham (see Vg).
Bush Hill Park, Enfield (see Vg).
Camden Town, 60-160, N.
Camden Hill (see Vg).
Castle Hill and Castle Bar (see Vg).
Catford Bridge (see Vg).
Central Hill, Norwood, 320, S.
Chalk Farm, 110, N.
Champion Hill, Camberwell, 140, S. (W.)
Chigwell (see Vg).
Childs Hill, 240, N.W.
Chingford, 158, N.E.
Clapham (see Vg).
Claygate Esher, 100, S.W. (Bg.)
Clissold Park, 100, N. (Lm.)
Colney Hatch (see Vg).
Coombe, 143, S.W.
Cottenham Park, Wimbledon, 60, S.W.
Crabtree Hill, Lambourn, 200, S.E. (Bg.)
Cricklewood (see Vg).

Crofton Park, Lewisham, 100, S.E.
Crouch End, 148, N.
Crystal Palace, 363, S.
Dartmouth Park, 180, S.E.
Denmark Hill, 65, S.
Dollis Hill, 234, N.W. (G.)
Drayton Park, Highbury, 100, N.
Dudding Hill, 157.
Dulwich, 90-150, S. (W.)
,, *Wood Park*, 250, S.
Earlsfield (see A).
Eastcote, 140, N.W. (W.)
Eden Park, 180. (Bl.)
Edgware, 180, N.W.
Egham (see Vg).
Elmer's End (see Vg).
Elstree, 478, N.W.
Elthorne Hanwell (see Vg).
Epping (see Bcl).
Esher, 100, S.W. (Bg.)
Finsbury Park, 160, N.
Forest Hill, 170, S.
Friern Barnet, 200, N. (G.)
Gipsy Hill, Norwood, 210, S.
Golder's Green, 200, N.
Gospel Oak, 150, N.
Green Lanes, 100, N. (Lm.)
Green Park (see Vg).
Greenford (see Vg).
Greenhill, Harrow, 200, N.W.
Hackney Wick (see A).
Hadley Wood, 300, N.
Hainault Forest (see Vg).
Hampstead, 180-438, N.W. (Bg.)
Hangers Hill Park, Ealing, 200, N.W.
Harefield (see C).
Harlesden, 150, N.W.
Harringay Park, 150, N.
Harrow 345, N.W. (Bg.)
Harrow Weald, 180-220, N.W.
Hatch-end, Pinner, 220, N.W.
Haverstock Hill, 100-180, N.W.
Herne Hill, 135, S.
Highams Park, Chingford (see Vg).
Highbury (see Vg).
Highgate, 170-427, N. (Bg.)
Highwood, Essex (see Bcl).
,, Hill, 462, N.W. (G.)
Hither Green (see Vg).
Holland Park, 82, W. (Lm.)
Holloway, 90-137, N.
Honor Oak, Forest Hill, 150-200, S.E.
Hook, Long Ditton, 120, S.W.
Hornsey, 100, N.
Horsenden Hill, Harrow, 278, N.W.
Hyde Park (see Vg).
Ickenham, 135.
Islington (see Vg).

London Clay

Jack's Hill, Epping, 373, N.E. (G.)
Kensal Green, 110, N.W.
 „ *Rise*, 140, N.W.
Kentish Town, 100-130, N.
 Keston, Harrow, 130, N.W.
Kidbrooke, 100-150, S.E. (Bl.)
Kilburn, 100, N.W.
 Kingsbury (see Vg).
Knightsbridge (see Vg).
 Knotts Green (see Vg).
 Lambourn (see Bcl).
 Langdon Hill, 398, (Bg. G.)
Lewisham (see Vg).
 Leytonstone (see Vg).
 Long Ditton, 80, S.W.
Lordship Lane, Sydenham, 250, S.E.
 „ *Park*, 90, S.E.
 Loughton, 120, N.E. (G.)
Maida Hill, 105, N.W.
 „ *Valer*, 100, N.W.
 Malden, 80, S.W.
 Merton (see Vg).
 Mill Hill, 400, N.W. (G.)
 Milton Park, Highgate, 300, N.
 (Bg.)
 Minims, South (see C).
 Morden, 85, S.W.
 Mottingham, 90-140, (Bl.)
 Neasden, 160, N.W.
New Cross (see Vg).
 New Malden, 45, S.W.
 Noel Park, Wood Green, N.
 Norbiton, 50, S.W.
 Norbury (see Vg).
 Northold, 129.
Norwood, 150-370, S.
Notting Hill (see Vg).
Nunhead, 100, S.E.
 Oakleigh Park, East Barnet, 200, N.
 (G.)
 Oravy Park (see Bcl).
 Oxshott, Esher, 246, S.W. (Bg.)
 Page Green, Tottenham, 36, N.
 Palmer's Green (see Vg).
Parliament Hill, 319, N.
 Penge, 150-200, S.
 Pinner (see Vg).
 Primrose Hill, 216, N.
Putney (see Vg).
 Queen's Park, Kilburn, 150, N.W.
 Ravensbourne Park (see Vg).
 Raynes Park, 45, S.W.
Regent's Park, 138, N.W.
 Richmond (see Vg).
 Roehampton (see Vg).
 Romford (see Vg).
 Rosslyn Park, Hampstead, 330, N.W.
 (Bg.)

Roxeth, Harrow, 240, N.W.
 Ruislip, 150, N.W. (W.)
St. John's Wood, 160, N.W.
St. Pancras, 80, N.
 St. Quintin's Park, 50, N.W.
 Selhurst, Croydon (see Vg).
 Shacklewell (see Vg).
Shooters Hill, 418, S.E. (G.)
 Snarebrook (see Vg).
Somers Town, 70.
 South Beckenham (see Vg).
Southfields, Wimbledon (see Vg).
 Stamford Hill (see Vg).
 Stanmore, 300, N.W. (G.)
 Stoke D'Abernon (see Vg).
 „ *Newington*, 100, N. (Im.)
 Stonebridge Park, 90.
Streatham (see Vg).
 Stroud Green, 150, N.
 Sudbury, 200, N.W.
Summers Town, Tooting (see A).
 Surbiton (see Vg).
Sydenham, 300, S.E.
 Temple Fortune 200, N.W. (G.)
 Theydon Bois (see Bcl).
 „ *Gernon* (see Bcl).
 „ *Mount* (see Bcl).
 Tollington Park, 120, N.
Tooting (see Vg).
 Tottenham (see Vg).
Tufnell Park, 120, N.
Tulse Hill, 182, S.
 Twyford, 100, N.W.
 Walthamstow (see Vg).
Wandswoth (see Vg).
 Wanstead (see Vg).
Waterlow Park, 300, (Bg.)
 Wealdstone, Harrow, 200-220, N.W.
 Wembley Park, 120-200, N.W.
West End, Hampstead, 180-300,
 N.W.
Westbourne Park, 75, W.
Westow Hill, Norwood, 368, S.
 Willesden, 100-170, N.W.
 Wimbledon (see Vg).
 Wood Green, 112, N.
 Woodford, 169, N.E. (G.)
 Worcester Park, 100, S.W.
Wormwood Scrubs, 50, N.W.
Gravel of Higher Grounds (pebble,
 gravel, and shingle, or coarser sub-
 angular gravel and sand).
 Aldenham (see C).
 Barnet (see L).
 „ *East* (see L).
 Bentley Priory, 500, N.W.
 Buckhurst Hill, 240, N.E.
 Chorley Wood (see C).
 Dollis Hill (see L).

Gravel of Higher Grounds

Finchley (see Bcl).
 Friern Barnet (see L).
 Harefield (see C).
 High Beech, 300, N.E. (Bg.)
 Jack's Hill, Epping (see L).
 Lambourn (see Bcl).
 Langdon Hill (see L).
 London Colney (see C).
 Loughton (see L).
 Mill Hill (see L).
 Minims, South (see C).
 Monken-Hadley, 420, N.
 Muswell Hill (see Bcl).
 Oakleigh Park (see L).
 Oravy Park (see Bcl).
 Shenley, 207, N.W.
Shooters Hill (see L).
 Southgate 220, N.
 Stanmore (see L).
 Temple Fortune (see L).
 Theydon Mount (see Bcl).
 Totteridge, 410, N.W.
 Whetstone, 312, N.
 Winchmore Hill, 150, N.
 Woodford (see L).

Blackheath Beds (*d*) (gravel composed of flint and pebbles in a sandy matrix).

Abbey Wood, Plumstead, 100, S.E. (T. W.)
 Addiscombe (see Vg).
 Beckenham, 130, S.E.
 Belvedere (see A).
Bexley Heath, 160, S.E.
Bickley, 237, S.E.
Blackheath, 100-150, S.E.
Bostall Heath, 216, S.E. (T. W.)
 Bromley, Kent, 200, S.E.
Charlton (see C).
 Chislehurst (see C).
 Croydon (see C).
 Eden Park (see L).
 Elmers End (see Vg).
Eltham, 80-220, S.E. (W.)
Greenwich (see Vg).
 Hayes, Kent (see Vg).
 Keston (see C).
Kidbrooke (see L).
Lee, 50-110, S.E. (W.)
 Maze Hill, 132, S.E. (T. W.)
 Mottingham (see L).
 Selhurst (see Vg).
 Shortlands (see Vg).
 Sidecup, 150, S.E.
 Sundridge Park (see C).
 Wellington, Bexley, 150, S.E.
Westcombe Park (see C).

Wickham, East, 150, S.E. (W.)

West, 261, S.E.

Woolwich (see C).

Bagshot Beds (*e*) (largely composed of sand).

Claygate (see L).
 Coombe Wood, 177, S.W.
 Crabtree Hill, Lambourn (see L).
 Esher (see L).
 Harrow (see L).
 High Beech (see G).
 Highgate (see L).
 Highwood (see Bcl).
 Lambourn (see Bcl).
 Milton Park (see L).
 Oxshott (see L).
 Rosslyn Park (see L).
Waterlow Park (see L).

Thanet Beds (*f*) (fine or loamy sand).

Abbey Wood (see Bl).
 Ashted (see C).
 Beddington (see C).
Bostal Heath (see Bl).
Carshulton (see C).
Charlton (see C).
 Cheam (see C).
 Cray, North (see C).
 Crayford (see C).
 Erith (see A, C).
 Ewell (see C).
Maze Hill (see Bl).
Plumstead, 50-100, S.E.
 St. Mary Cray (see C).
 St. Paul Cray (see C).
 Sundridge Park (see C).
 Sutton (see C).
 Swanley (see C).
 Waddon (see C).
 Wallington (see C).
Westcombe Park (see C).
 Wickham Court (see C).
Woolwich (see C).

Lower Greensand (loose sand).

Betchworth (see Vg).
 Leybourne (see Vg).

Woolwich and Reading Beds (*g*) (sands, shelly layers, pebble beds, or gravel and mottled clay).

Abbey Wood (see Bl).
 Ashted (see C).
 Belvedere (see A).
Bostal Heath (see Bl).
Brockwell Park (see L).
Champion Hill (see L).
Charlton (see C).
 Cheam (see C).
 Chislehurst (see C).

Woolwich and Reading Beds (g)

Cray, North (see C).
 Croydon (see C).
Dulwich (see L).
 Eastcote (see L).
Eltham (see Bl).
 Epsom (see C).
 Ewell (see C).
Greenwich (see Vg).
 Harefield (see C).
Hither Green (see Vg).
 Keston (see C).
Knight's Hill, Dulwich, 215. S.
Ladywell, 53, S.E.
Lec (see Bl).
Lewisham (see Vg).
Maze Hill (see Bl).
 Mimms, South (see C).
 New Cross (see Vg).
 Northwood Pinner, 250. N.W.
Peckham (see Vg. W).
 „ *Rye*, 50-100, S.E.
 Pinner (see Vg).
 Ruislip (see L).
St. John's, Lewisham (see Vg).
 Shortlands (see Vg).
 Sundridge Park (see C).
 Sutton (see C).
Westcombe Park (see C).
 Wickham, East (see Bl).
Woolwich (see C).

Valley Brick-earth, or Loam (h) (brown loam, or variable sandy clay).

Abney Park (see L).
 Acton (see Vg).
Balham (see Vg).
Balls Pond, 70, N.
 Barnes (see Vg).
Battersea (see Vg).
Bayswater (see Vg).
 Bedford Park, 30, W.
 Betchworth (see Vg).
Bethnal Green (see Vg).

Bloomsbury (see Vg).
 Brentford (see Vg).
Brook Green, 17, W.
Camden Hill (see Vg).
 Churchbury (see Vg).
Clapton (see Vg).
Clissold Park (see L).
 Cowley (see Vg).
 Crayford (see C).
 Dawley (see Vg).
 Ealing (see Vg).
 Edmonton (see Vg).
 Enfield (see Vg).
 „ *Highway* (see Vg).
 Finchley (see Bel).
 Green Lanes (see L).
Hammersmith (see Vg).
 Hayes, Middlesex (see Vg).
 Heston (see Vg).
Highbury (see Vg).
 Highwood (see Bel).
Holland Park (see L).
 Ilford, Great (see Vg).
Kensington (see Vg).
Mildmay Park, 75.
Newington Green (see Vg).
Old Ford (see Vg).
 Oravy Park (see Bel).
 Osterley Park (see Vg).
Parsons Green (see Vg).
Peckham (see Vg).
Ravenscourt Park, 17, W.
Shepherd's Bush (see Vg).
 Southall (see Vg).
 Starch Green, 25, W.
Stepney (see Vg).
Stoke Newington (see L).
 Strand on the Green (see Vg).
 Turnham Green, 25, W.
Walham Green (see Vg).
Wandsworth (see Vg).
 West Drayton (see Vg).
 Yeading Hayes, 100, N.W.
 Yiewsley (see Vg).

REPORT ON THE EAST COAST

By WILLIAM MURRELL, M.D., F.R.C.P.

THE district included within this Report comprises the coast-line from the mouth of the Thames on the south to the mouth of the Humber on the north.

It is divided into four counties :—

1. Essex, from the Thames to the Stour.
2. Suffolk, from Harwich to Great Yarmouth.
3. Norfolk, from Great Yarmouth to the Wash.
4. Lincolnshire, from the Wash to the Humber.

The health resorts situated within the region are numerous, and with the single exception of Woodhall Spa in Lincolnshire, are all to be found upon the sea-coast. Of these the most important, enumerating them according to their counties, are the following:—

IN ESSEX.

1. CLACTON-ON-SEA, FRINTON-ON-SEA, and WALTON-ON-THE-NAZE.
2. SOUTHEND.
3. DOVERCOURT.

IN SUFFOLK.

4. FELINSTOWE.
5. ALDEBURGH.
6. SOUTHWOLD.
7. LOWESTOFT.

IN NORFOLK.

8. GREAT YARMOUTH.
9. CROMER and the adjacent villages of OVERSTRAND, SIDESTRAND, TRIMINGHAM, and MUNDESLEY-ON-SEA.
10. WELLS.
11. HUNSTANTON.

IN LINCOLNSHIRE.

12. SKEGNESS.
13. SUTTON-ON-SEA.
14. MABLETHORPE.
15. CLEETHORPES.

It must not be supposed, however, that these health resorts exhaust the list of places at which, in summer at least, accommodation may be obtained, by those desiring to enjoy the stimulating air and other advantages to be derived from an East Coast holiday.

On the contrary, so popular of late years has this region become, that there is hardly now a village along the coast at which lodgings may not be obtained. Since, however, as a rule the climatic conditions observed at these smaller places do not differ materially from those obtaining at the better known health resorts, the latter alone will be specially considered in this Report.

General Description of the Counties.

Essex.—Its extreme length from north to south is 50 miles.

Its chief headlands are the Naze, $5\frac{1}{2}$ miles south of Harwich, Foulness at the mouth of the Crouch, and Shoeburyness at the mouth of the Thames.

The chief rivers, excluding the Thames and the Stour, are the Crouch, the Blackwater, and the Colne.

The greater part of the county consists of London clay, but a considerable tract north of Sudbury is occupied by Post-Pliocene deposits consisting of loam with fragments of chalk covering the substrata of eocene rocks. The surface of the soil does not rest immediately on the London clay, but on alluvial beds of rich marl and loam which alternate with gravel and sand and sometimes have a thickness of 30 or 40 feet. The geological formation of much of the sea-board is fresh-water deposit, the soil being of a rich alluvial character interspersed with clay. The sea-board is low and flat, and in some places marshy. At one time it suffered much from the encroachment of the sea, but in many places it is now protected from further injury by strong embankments. Shoals and sands lie off some parts and numerous islands are situated within the general coast-line, being as a rule divided from the interior only by narrow belts of water.

Suffolk.—The greatest length north to south, from Yarmouth to Landguard Point, is 50 miles. The coast-line has a length of 52 miles, and is comparatively regular. The shore is generally low and marshy with occasional clay and sand cliffs. The principal geological formations are the chalk and the tertiaries, but they are frequently overlaid by drift. Towards the south the chalk passes under the London clay and crag. The rivers which flow in a south-easterly direction to the North Sea are the Blyth, the Alde or Ore, which runs a course for a long distance parallel to the sea-

shore and has its port at Orford, the Deben from Debenham, the Orwell or Gipping, and the Stour, which forms nearly the whole southern boundary of the county, receives the Brett, and has an important port at Harwich.

Norfolk.—The greatest length from north to south is 42 miles. The coast-line is flat and low, and has been much encroached on by the sea. From the mouth of the Yare to Happisburgh the shore is low and sandy, and is skirted by sandbanks. Then for a distance of about 20 miles it is formed, consisting of clay and masses of rocks. These cliffs are not as a rule more than 50 feet high, but in places they run up to 200. The cliffs are succeeded by a low shingly or sandy coast stretching as far as St. Edmund's Point. The shores of the Wash are formed of mudbanks which are left dry at low water.

The principal rivers are the Yare on the east, with its tributaries the Bure, the Wensum and the Waveney, and in the west the Ouse with its tributaries the Little Ouse, the Wissey and the Nar. On the north coast there are few bays or inlets, and there are no mouths of rivers.

The general surface is undulating with rising ground skirting the river valleys. Nearly the whole of Norfolk is composed of chalk, but from the amount of drift deposit it forms a comparatively small portion of the surface.

From the exposure of the coast to east and north-east winds, the temperature, especially in winter and early spring, is somewhat lower than that of the adjacent counties, but the air is dry and there is very little fog.

Lincolnshire.—Lincolnshire is the second, in point of size, of all the English counties, and comprises within its area 2611 square miles. From the Humber in the north to the Welland in the south, the distance is 76 miles, while from the Trent on the western border of the county to the German Ocean it measures 48 miles.

The county is divided into three separate divisions, called respectively, Holland, Kesteven, and Lindsey. Of these Holland is the smallest in point of size. It forms the south-eastern border of the county, and consists entirely of fertile fen-land. It is famed for the beauty of its numerous churches. Kesteven bordering on Holland on the west contains only a strip of fen-land, and is

composed for the most part of undulating and wooded country. Through it also runs the "Cliff" range of hills, which at Lincoln presents so steep a western escarpment. Lindsey lastly forms the northern portion of the county. But little fen-land is comprised within its area, though the strip of country along its eastern shore, lying between the East Lincoln Railway and the sea, is very flat. The central portion of this division, however, is formed by the chalk hills, termed the Wolds, while west of this again the "Cliff" range continues its northward course until it ends at the Humber. It will be seen, therefore, that contrary to the usual opinion only a comparatively small portion of the county is in reality flat fen-land, while much on the contrary is undulating and even hilly.

Geologically the jurassic and cretaceous strata, together with extensive alluvial deposits, constitute the chief formations met with.

The sea-coast of the northern or Lindsey division of the county is sandy and well adapted for bathing. It is bordered, however, by a line of low sandhills or "dunes," which together with the flatness of the surrounding country rob it of all claims to the picturesque. The coast of Holland, or the southern division of the county, consists on the other hand almost entirely of inaccessible mud-flats.

The chief rivers of the county are the Trent in the north, the Witham in the centre, and the Welland in the south.

Meteorology and Climate.

The following Tables (see page 85) compiled from the observations made during the years 1881—1890 at Hillington in Norfolk, and Lowestoft and Somerleyton in Suffolk, based upon the figures published by Mr. Bayard in the *Quarterly Journal of the Royal Meteorological Society* for 1892, represent the chief meteorological conditions obtaining in this district. Very similar data also from Great Yarmouth (Norfolk) will be found on page 107.

From these systematic observations it would appear that the East Coast stations are neither very cold in winter, nor excessively hot in summer. The mean minimum temperature at Lowestoft for the year is 42.2, which is practically identical with that of London, and only 3.3 degrees lower than that of Ventnor. The

MEANS FOR TEN YEARS (1881-90)—QUARTERLY AND YEARLY.

Station, HILLINGTON, NORFOLK. Height above Mean Sea-level, 88 feet.

REV. H. E. B. FOLKES, M.A., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.			Mean Temperature of Air.	Mean Relative Humidity.	Amount of Sunshine. (Hours.)	Mean Cloud.	RAIN.	
	Mean of Highest.	Mean of Lowest.	Mean Daily Range.					Days it fell.	Inches.
Jan.—March	44.3	32.2	12.1	38.2	80	214.5	7.7	46	5.53
April—June	60.5	42.1	18.4	51.3	77	540.2	7.2	41	5.47
July—Sept.	67.8	49.4	18.4	58.6	79	489.3	6.9	43	8.55
Oct.—Dec.	47.9	36.6	11.3	42.2	91	184.4	7.5	53	7.85
Whole year	55.1	40.1	15.1	47.6	84	1457.4	7.3	183	27.40

MEANS FOR TEN YEARS (1881-90)—QUARTERLY AND YEARLY.

Station, SOMERLEYTON, SUFFOLK. Height above Mean Sea-level, 50 feet.

REV. C. J. STEWARD, M.A., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.			Mean Temperature of Air.	Mean Relative Humidity.	Mean Cloud.	RAIN.	
	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	44.4	33.0	11.4	38.7	87	6.8	44	4.78
April—June	58.1	43.3	14.8	50.7	77	6.4	36	4.86
July—Sept.	66.6	51.1	15.5	58.8	77	6.3	42	7.40
Oct.—Dec.	48.9	38.0	10.9	43.4	87	6.9	53	8.41
Whole year	54.5	41.4	13.1	47.9	82	6.6	175	25.45

MEANS FOR TEN YEARS (1881-90)—QUARTERLY AND YEARLY.

Station, LOWESTOFT, SUFFOLK. Height above Mean Sea-level, 85 feet.

S. H. MILLER, Esq., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.			Mean Temperature of Air.	Mean Relative Humidity.	Mean Cloud.	RAIN.	
	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	44.0	34.2	9.8	39.1	89	7.0	43	4.30
April—June	56.6	43.9	12.7	50.2	79	6.4	36	4.66
July—Sept.	65.8	51.0	13.9	58.8	77	6.6	43	7.32
Oct.—Dec.	49.1	38.9	10.2	44.0	88	7.0	51	7.88
Whole year	53.9	42.2	11.7	48.9	83	6.8	173	24.16

mean maximum temperature at Lowestoft for the year is 53·9 degrees. The coldest months at Lowestoft are January and February, whilst the hottest month is July. The mean relative humidity at 9.0 a.m., taking the average of the year, was 83, whilst the mean amount of cloud was 6·8. The mean rainfall at Lowestoft for the ten years averaged 24·16 inches a year. The number of rainy days (0·01 inch and upwards) is 173 in the year, as compared with 189 at Ilfracombe, 204 each at Sidmouth and Falmouth, 165 in London, 164 at Ventnor, and 159 at Brighton. Practically less rain falls in the east than in the west, and the rate of fall increases as we travel west.¹

Respecting the general climatic conditions of the East Coast watering-places it may be stated that they are bracing and invigorating. In the winter and early spring it is somewhat cold, and east winds are prevalent. There is, however, an abundance of sunlight, and fogs are not common. In the summer and autumn, sometimes even as late as the end of November it is warm, and even invalids can take daily exercise in the open air.

The East Coast watering-places during the greater part of the year are admirably adapted to the requirements of delicate children, and to both children and adults convalescent from long illnesses, or who are recovering from the effects of surgical operations. Cases of anaemia almost uniformly do well, and good results are reported in early phthisis. Except during the summer and early autumn months, cases of rheumatism, and especially of neuritis and neuralgia should not be sent to the East Coast.

¹ For further details on this subject see pp. 127-129; and compare also the Rainfall Map there reproduced.

SPECIAL DESCRIPTION OF THE INDIVIDUAL HEALTH RESORTS.

ESSEX.

CLACTON-ON-SEA.

*(The following Report is founded chiefly upon Notes furnished by
T. G. Wakeling, Esq., M.R.C.S., L.R.C.P.)*

Clacton-on-Sea faces nearly due south, and is protected by cliffs from the north winds, and to some extent also from the east. The immediately surrounding country is flat and wooded. The town is built upon a gravel subsoil resting at a depth of 28 feet upon the London clay. The resident population is now 7,453.

The air is bright, clear and bracing, and much brilliant sunshine is experienced. Fogs are very rare at Clacton, even when other portions of the Channel district are suffering from them. The rainfall is very small. Thus in 1897 it only amounted to 21 inches, and in one year, according to Symons' *British Rainfall*, the total fall here was less than that of any place in England with one single exception. The prevailing wind is from the south-west.

Trees have been planted in all the streets and in the surrounding districts by the Urban District Council. Flowers flourish exceptionally well, especially roses, the latter, with lobelia and geraniums, living in the gardens all the year round.

The Springs at Clacton are cold and east winds are prevalent. The Summers are dry and hot. The Autumns are bright, fine and dry, often till mid-November. The Winters are mild. Perhaps however the chief peculiarity of Clacton-on-Sea is its dryness. This is due to several causes, amongst which may be mentioned the following:—

1. The small rainfall.
2. The porous nature of the soil.
3. The well-made roads and paths, the latter being made of

tar-paving, except along the Front (Marine Parade) where they are 12 feet wide and constructed of Victoria stone.

4. Efficient drainage.

Drainage.—This consists of sewers, with flush tanks and ventilating shafts. The sewers have been relaid during the last five years. The outfall into the sea is about one mile from the town.

Water Supply.—At present this is derived wholly from wells sunk in the gravel and sand of the Thanet Sand, Woolwich and Reading Beds. Wells in the chalk near the coast contain too much salt to be potable and are not used. Deep wells however are now being sunk in this formation about 9 miles from the town, and a new water supply is thus being laid on.

The Prevalence of Diseases and the Therapeutic Effects of the Climate.

A. *Anæmia and Debility.*—The anæmia of constipation is the chief and practically the only variety met with. All cases of debility sent here are greatly benefited.

B. *Scrophula and Tuberculous Diseases* are very rare.

C. *Phthisis* is rare amongst permanent residents owing to the dryness of the climate. Visitors suffering from the first stage of phthisis are greatly benefited, a fact evidenced by the statistics of the Essex Convalescent Home.

Hæmoptysis amongst the natives is rare. It occurs among phthisical visitors, but is seldom fatal.

<i>Bronchitis and Catarrh:</i>	} Not by any means common.
<i>Pneumonia:</i>	
<i>Pleurisy:</i>	

Asthma.—Among natives uncommon. As in other places some imported cases are benefited, while others are made worse.

D. *Acute Renal Dropsy* is not common: it occurs chiefly in conjunction with alcoholism.

Chronic Albuminuria is very uncommon; when it occurs it is usually due to granular kidney.

Calculus and Gravel.—Calculus is rare. Uric acid gravel cases occur occasionally in the winter months.

E. Acute Rheumatism is rare.

Rheumatoid Arthritis is not at all common.

Rheumatic patients often derive much benefit from a stay during the summer and autumn months.

Neuralgias of periodic type are common in spring. Among visitors, neuralgia if arising from pure debility is greatly benefited.

F. Skin Diseases are very uncommon.

G. Malarial affections are now very rare. When the present old inhabitants were young, malaria was prevalent, but owing to better drainage, cases are now but seldom met with.

Typhoid Fever.—Up to 1896 this disease was practically unknown. Owing, however, to the increase in the number of visitors, a few cases have occurred in the last few years.

Diarrhoea: Only prevalent in the summer months, and chiefly amongst children.

Scarlet Fever.—Generally imported.

Diphtheria.—Not common.

In conclusion it may be said that the effect of the climate on disease is especially well marked as seen in the case of the convalescents sent to the Essex and the Middlesex Convalescent Homes. The majority of these patients are sufferers from the after-effects of operations and illnesses of various kinds.

The climate is not suited to kidney disease. Heart cases do well.

Clacton-on-Sea is especially suitable for chest cases which require a bracing air, the best time being from end of April to December. Phthisis with proper hygienic treatment does remarkably well, it being not uncommon to see a gain in weight of from one to four pounds per week.

FRINTON-ON-SEA and WALTON-ON-THE-NAZE.

In close proximity to Clacton, and slightly to the north of it, are situated **Frinton-on-Sea** and **Walton-on-the-Naze**. Both are typical East Coast watering-places, the climatic conditions of which are very similar to those occurring at Clacton. Owing, however, to their not enjoying the southern aspect possessed by the former, the east winds in them are more severely felt.

SOUTHEND.

Of **Southend**, situated at the mouth of the Thames on the very southern border of the county, no detailed description is required in this Report. The air indeed is admirable and bracing, but owing to the innumerable excursionists who are annually transported thither, the place is rendered hardly suitable for the invalid.

DOVERCOURT.

Dovercourt in Essex is a portion of the Borough of Harwich, and is 70 miles from London. The normal population amounts to about 2,000, but the number of residents is greatly increased during the summer months by the influx of visitors. Although on the East Coast it is so situated that the cliffs on which the best houses are situated face south. The whole of the town is situated on clay. The harbour is very extensive, and one of the best on the coast. There is a good and abundant water supply, and in addition a spring exists of which the water has the same composition as that of Tunbridge Wells, but it is rarely used. The drainage system is modern. Until recently privies were in use in some parts of the town, but these have been condemned and swept away. It is essentially a quiet place, but a good centre for excursions, the sail up the Orwell to Ipswich being the favourite. Good boating, and in the winter deep-sea fishing are to be obtained. The season lasts from June to the end of September. The spring months are very enjoyable, but very few visitors come at this season. Dovercourt is a healthy bracing place with a low rate of mortality. Enteric fever is almost unknown, and phthisis is very uncommon among the inhabitants. It is admirably adapted for weakly children and for convalescents from acute illnesses and surgical operations. All diseases of a scrofulous nature do well. Good results are obtained in early cases of phthisis, but patients in advanced stages do very badly. The neighbourhood is also unsuited for neuralgic affections, and especially for rheumatism. Cases of asthma too nearly always do badly. The inhabitants

live to a great age. They are a primitive race, and very courteous and obliging to strangers.

Harwich itself is quite unsuited for a health resort, and visitors should be sent to Dovercourt.

SUFFOLK.

FELIXSTOWE.

*(The following account is founded on Notes contributed by Dr.
Charles Graham Havell.)*

The modern watering-place, **Felixstowe**, of which the resident population now amounts to 5,805, is composed of the two ecclesiastical parishes of Felixstowe and Walton.

It forms the seaboard of an irregular parallelogram of land, included between the two tidal rivers, the Orwell and the Deben. At the mouth of each of these rivers is a stretch of sandy common or links; that on the north bank of the Deben forming the well-known Golf Links, that on the north bank of the Orwell Landguard Common, the extreme south-easterly point of which is Landguard Fort, a place of great military strength and importance. Between these two commons is an elevated plateau presenting a sea-front of about two miles, on which Felixstowe proper is built. The outlook seaward is southerly by a little easterly, so that the place is sheltered from northerly and easterly winds.

The plateau above-mentioned is composed of a formation known as the Suffolk red clay, which rests on the London clay. The former is of very light porous consistence, ensuring a dry surface. At the sea margin the elevation varies from 30 to 60 feet, the ground falling by easy slope towards each of the rivers. A rise of a few feet occurs landwards for a few hundred yards, and then a gradual declivity towards a tract of low grass country about half-a-mile to a mile inland.

The surface is bare of trees, except such as have been planted in connection with building operations, and they are not yet of sufficient growth to afford much protection, or to modify climate.

The ocean currents are of no climatic importance.

The rainfall is much below the average, protection being afforded by the rivers Orwell and Deben. The actual number of days on which over 0·01 inch of rain fell in 1891 was 190, and the amount in inches 21·99. In 1890 the figures were 168 and 21·52 respectively. Fogs are rare, and the humidity is small in amount.

The early months of the year are characterized by cloudy skies and easterly and north-easterly winds, which make the place unsuitable for invalids. The climate generally is bracing, but from its southerly aspect the air is less keen than that of the north-east coast of Kent, towards which it looks. The special feature of this coast is the fine, still autumn season and early winter. There are many days continuously in which it is possible to spend the greater portion on the beach in warm, bright sunshine, and still air even in November and December.

Drainage.—Felixstowe is at present drained only in cesspools. A scheme has been adopted by the Local Authority by which the sewage of the district is to be disposed of on the "Shone" pneumatic principle, whence it will be forced to the outfall station in low-lying land near the Orwell, thence into the mouth of Harwich harbour at ebb tide. The tidal current is there powerful, and will carry it well out to sea.

Water Supply.—In all the modern houses in Felixstowe the water is supplied by the mains of the water-company, whose principal supply is derived from a well 500 feet deep, sunk in the chalk. Subsidiary supplies are derived from a spring in the formation known as the "Suffolk Crag," and from upland surface water collected from the ground at the back of Felixstowe, well away from habitations. These sources have been repeatedly analyzed and found of good quality, though the hardness is high. Many of the old houses are still supplied from surface wells.

Prevalence of Disease.

A. Anæmia and Debility.—Very unusual among residents. Many cases of anæmia which have been treated with long courses

of chalybeates at home recover here without any medicine, with the exception of an occasional simple aperient.

B. *Scrophula and Tuberculous Diseases*.—It is in these cases, particularly in those occurring in the joints and bones of children, that the benefit of the Felixstowe climate is most marked. Residents have a distinct immunity from these affections.

C. *Phthisis* is rare among residents. Felixstowe is well suited for cases without much excavation, but the first four months of the year should be avoided. Hæmorrhagic cases receive particular care at the Convalescent Home, because the patient's general condition improves so quickly that bleeding is sometimes induced by imprudences, but these cases as a rule do well.

Chronic bronchitics do well, except in the spring months—so well, indeed, that many such patients, after trying other localities, have finally settled in Felixstowe.

D. *Renal Disease*.—Acute renal dropsy (except scarlatinal) is very rare.

Renal Calculus is very uncommon.

E. *Rheumatism*, in the form of chronic senile rheumatism, is prevalent.

Rheumatic Arthritis.—Uncommon.

Neuralgia.—Common in first arrivals with carious teeth. But chronic cases generally do well.

F. *Malarial affections* are never seen, and tropical cases do well.

Typhoid Fever.—Rarely seen, with the exception of a few imported cases.

Diarrhœa.—Uncommon; only five deaths having been recorded under this heading during the last five years.

Scarlet Fever.—Several outbreaks of a mild type have occurred during the last five years, but only two cases proved fatal.

Diphtheria appeared for the first time for ten years in 1898, causing six deaths. *Endemic sore throat* is unknown.

Common Causes of Death and frequency of Old Age.—

Diseases of the respiratory organs in infancy and old age are accountable for the largest proportion of deaths. Out of 233 deaths from all causes in the last five years 40 were in persons of 70 years and over.

Therapeutical Effect of the Climate.—Dr. Havell says:—

“If one could single out one group of affections in which the

Felixstowe climate is pre-eminently indicated, I should say it was the surgical diseases of childhood. Tuberculous diseases of glands and joints do admirably. Moreover the great extent of sea-front, fine safe beach, and almost complete absence of excursion traffic, give great facilities for the comfort and enjoyment of such patients. Mention may here be made also of the unique feature by which almost every house is provided with a tent or wooden hut on the beach, affording to delicate persons excellent protection from sudden storms, and proving moreover very convenient for bathing."

ALDEBURGH.

Aldeburgh is a sea-side village containing 2,405 inhabitants, which as a health resort is steadily increasing in popularity. It is on sandy soil with crag underneath, and has the reputation of being very dry. There are no cliffs or elevations, and it slopes gently to the sea. It is protected from the west, but there is no protection against east winds. There are few trees, but there is plenty of common-land. The rainfall is small and there is very little fog. The climate is dry and bracing all the year round, but east winds are prevalent in the spring. The drainage is into cesspools but good water is obtained from the water-works.

The climate is found to be beneficial in anæmia and debilitating diseases. The chief complaints amongst the native population are bronchitis and rheumatism. Calculus and gravel are almost unknown.

SOUTHWOLD.

For valuable notes for this Report the Committee is indebted to Dr. A. C. Herbert. Sir William Gowers has furnished some of the notes on the Therapeutical Effects of the Climate.

Definition of District and General Physical Characters.—**Southwold** is a small seaport, fishing-town, and municipal borough containing in 1901 a population of 2,800, and is situated on the coast of Suffolk, ten miles south of Lowestoft. It stands on a

promontory forming a low gravel hill with the unique peculiarity of being bounded in front by the sea, and behind by ground which is not above high-water mark. The valley of the tidal river Blyth divides into two branches separated by the hills on which Southwold stands and of which it occupies about a third, while the rest forms a large common to the south-west. The town with its common is practically on an island, bounded on the east by the sea, south-west by the Blyth, north-west by Buss Creek, a tributary of the Blyth, and only joined to the mainland on the north by a narrow strip of shingle which divides the Buss Creek from the sea and which is completely submerged at very high tides. Southwold stands in an exposed position, having but little protection from winds. It enjoys the free play of breezes that come in turn from every quarter, and it would be difficult to find any place which presents more strongly all the characteristics qualifying for "a bracing health resort."

Geological Formation and Soil.—The pebbly beds take up the surface of nearly the whole of the island (except for the bordering marshes, consisting of alluvium). It is for the most part gravel, which whilst chiefly consisting of flint pebbles, contains also much quartz. The whole has a sandy matrix, and there are often layers of light-coloured sand. Its low cliffs consist chiefly of pebbly gravel and sand. But a section (Geological Survey) about 250 yards north-north-east of the coast-guard station at the north end of the town is as follows:—

Sandy stony soil about	1 foot.
Boulder clay	3 feet.
Pale grey clay	4 „
Light-coloured and brown sand with gravelly layers	3 ..
Sandy pale boulder clay and loam and sand	8 „
Gravel, chiefly pebbles of flint and chalk	1 „
Crag, coarse ferruginous sand with broken shells	6 „

The crag at Southwold reaches to a depth far greater than is recorded anywhere in England. In the boring made when the well was sunk for the water-works, 147 feet were passed through. Chalk was reached at the depth of 580 feet. This porous gravelly sandy soil makes the place very dry, absorption proceeds rapidly and the heaviest falls of rain are quickly soaked up. The surface of

the hill slopes towards the Blyth, and its tributary on the south-west and north-west, and the natural drainage of the district is all in that direction. The surface is gently undulating, and the highest point is near the church, which stands about 40 feet above mean sea-level.

Trees and Vegetation.—Trees, of which the principal are elms, ash, evergreen oak, sycamore, and horse-chestnut, are found chiefly on the southern half of the town, nearly all on the north side having been cut down during building operations. They spread across the west side, but are not numerous. Vegetation is abundant. Shrubs of all kinds are found, laurustinus, tamarisk, clematis, virginia creeper, jasmine, sweet-briar, and roses of various kinds. Fruit-trees abound, apple, pear, plum, fig, grape, also gooseberry and currant. In the flower world the following grow well—asters of different varieties, carnations, marguerites, chrysanthemums, dahlias, geraniums, and many others. Wild flowers and ferns are in great abundance, also grasses of various kinds, as well as wild beet and spinach. Whilst, however, all these flourish, they are not all extensively cultivated, on account of the scarcity of ground. The acreage is not extensive (only some 640 acres) and the town is spreading so rapidly that the land is being fast taken up for building purposes.

Climate and Meteorology.—No attempt at systematic observations was made prior to the end of 1895. It is a generally received idea that the rainfall is small, the soil dry, the atmosphere pure and bracing, and the amount of bright sunshine large. Appended is a summary for 1897:—

Pressure of Atmosphere—Mean 29.900.

Temperature of Air—Mean of highest 55.2°.

„ „ lowest 44.2°.

Annual mean 49.6°.

Mean daily range about 11.0°.

Highest recorded in shade 78.5° (July), lowest 25.0° (January).

Hours of brightest Sunshine.—From the beginning of March to the end of October there were only 11 days with no sun visible, and only 57 such throughout the year.

Rain.—Number of rainy days '01 and more, 180.

Amount collected, 19·29 inches.

Mean relative humidity, 80 per cent.

Mean amount of cloud, 6·4.

Wind.—Chiefly from west quarter. The prevailing wind is west, but in 1898 there was more south-east than usual.

Fog.—Very little. Some sea mist in December and January.

These figures differ but little from those of 1896 and point to dryness of the soil, equability of temperature and a large amount of bright sunshine.

Characters of Climate in different Seasons.—From May to Christmas the climate is bracing, the temperature is even, and with a pleasant breeze in the hotter weather. In the early winter it is a little warmer than London, and a picnic at the end of November is no uncommon occurrence. In the early part of the year, however, the bracing qualities of the climate approach the unendurable, except to the most hardy. May is often a cold month, and generally brings east winds. April is often warm and pleasant.

Drainage and Water Supply.—The system in use is the "International," and it has been working satisfactorily for about three years. The main sewer receives constant attention, and good flushing is carried out periodically, in addition to which a tank is placed in the market-place which flushes automatically the three main lines. The sewers are laid down on the straight line system, have good falls, and are self-cleansing. The sewage of the town is carried away under the common to the marshes on the north-west side where the outlet works are situated. These consist of three large sewage tanks, built of concrete, with a ferozom mixer. Beyond are three large filter-beds. The effluent is discharged above high-water mark into the Buss Creek, which joins the sea some two miles lower down. The sludge is treated in separate concrete beds, and is then carted into the country. The scheme is almost wholly a gravitation scheme.

The water supply is derived partly from the Water Company's mains and partly from surface wells distributed about the town. The Water Company's water is obtained from a well situated in the heart of the common sunk some 60 feet into the crag. They have a water-tower with reservoir capable of holding 40,000 gallons.

The service is constant, and at high pressure. Frequent analyses prove the water to be good and potable, but hard. Those who use the private well water generally claim it to be good, but in many cases it must be looked upon with suspicion owing to the proximity of cesspools, of which a good many still exist.

Prevalence of Disease.

A. *Anæmia and Debility*.—For visitors the bracing qualities of the place soon restore energy and improve the condition of the blood—it is remarkable how soon they recover themselves. Yet strange to say, there are an extraordinary number of natives, chiefly girls, who suffer from anæmia. It is amongst the poorer classes that this is found, it is probably to be ascribed to close quarters and overcrowding. The sanitary authorities are taking steps to remedy the evil; old cottages are being pulled down and new ones are being built.

B. *Scrophula, &c.*—Almost unknown. Visitors suffering in this way benefit wonderfully after a short stay.

C. *Diseases of the Respiratory Organs*.—*Phthisis*.—Number of deaths (in 6 years) 14, viz. 11 males, 3 females. This disease is not widely disseminated. It appears to exist in some two or three families, and these supply nearly all the fatal cases. One family alone has lost of recent years four sons and two daughters. There has been much intermarrying of families related to each other, and so the disease is perpetuated. There is generally some hæmoptysis—it appeared in every instance in the family referred to above, and in about two-thirds of the total number given. Visitors suffering from phthisis do very well from May to October, but should not be sent during the other part of the year.

Bronchitis.—In 6 years there were 11 deaths from this cause. 7 males and 4 females, all amongst the infants and aged. It appears occasionally during any prolonged period of cold, but is not actually prevalent.

Pneumonia.—The deaths from this cause in 6 years numbered 15. The disease was prevalent in 1892 during the influenza epidemic.

Pleurisy.—Very few cases occur.

Asthma.—As with phthisis, so with this trouble, it is confined to two or three families, but the cases are few.

D. *Renal Diseases*.—Acute Bright's disease, chronic albuminuria and calculus are all uncommon.

E. *Rheumatism*.—*Rheumatoid Arthritis and Neuralgia*.—A large number of rheumatic patients exist, many being absolutely crippled with rheumatoid arthritis. Southwold is a bad place for rheumatism, and one to which rheumatic patients should not come. Neuralgia is also a common trouble.

F. *Eczema*.—Is common, all other skin diseases being rare.

G. *Malaria*.—Unknown amongst natives, but it is not a good place for those who have ever suffered, an attack surely coming on after a short stay.

Typhoid Fever.—Is almost unknown.

Diarrhoea.—Some cases occur, but it is not a common trouble.

Scarlet Fever and Diphtheria.—There is a remarkable freedom from these zymotic diseases. A few cases occur, but they are chiefly imported ones.

Frequency of Old Age.—The longevity of life in Southwold is remarkable. In 6 years 60 old people have died, 25 between 70 and 80, 29 between 80 and 90, and 6 over 90. There are 30 now living (and there may be more) all over 80, and 3 of them over 90. None of these are bedridden, and the greater number are able to get about and do work in their houses. Of the fatal cases referred to above one or two succumbed to bronchitis, but in the great majority death was due to decay only.

Therapeutical Effects of the Climate.—Southwold possesses characteristics that qualify it to be regarded as one of the most bracing resorts in England. Its restorative power in all forms of general and nervous debility are remarkable. From May to October sufferers from phthisis do well, as also those afflicted with other respiratory diseases, especially asthma. But the climate is unsuited to those suffering from chronic rheumatism, or who have had malaria. Ague is unknown now, but undoubtedly the low-lying marshy ground in the neighbourhood once produced it and may now be a soil for some poison which acts on the predisposed. Cases of ordinary neuralgia benefit remarkably.

LOWESTOFT.

Lowestoft is a town situated on the sea-coast at the extreme north-east of the county of Suffolk, on either side of an artificial cutting connecting the river Waveney with the sea. The borough covers an area of 2,306 acres; and its resident population is now 29,842. The trade of the town is chiefly concerned with fishing and other similar industries.

The town is divided by river and harbours into two distinct portions. That on the north bank is known as the old town, that to the south of the river, which includes **Kirkley** and **Pakefield**, being for the most part of very recent growth.

From the level of the river the ground to the north slopes somewhat rapidly upwards, some parts of the old town being therefore at a considerable height above the sea-level. There are however a number of houses built on the Dunes, at the foot of the cliff, and consequently at so slight an elevation above the sea, that it is practically impossible to connect them with the sewerage system. The town south of the river is built on a plateau of sand, which, at the southern limit of the Borough, gradually rises towards the cliffs which commence at Kirkley. This, the new town, is almost entirely a residential quarter, being made up in large part of boarding and other lodging houses with a certain proportion of hotels and shops. The majority of the houses here have been erected within quite recent years, and the general sanitary arrangements are of a more satisfactory character than is found to be the case in many parts of the old town.

Meteorology.—The Table compiled from the observations made by Mr. S. H. Miller, F.R.M.S., during the years 1881–1890, and printed on p. 85, demonstrates the chief climatic features of the neighbourhood.

The average rainfall at Lowestoft amounts to 24 inches per annum. From the following comparative Table it will be seen that this is less than that of most other places and districts in England and Wales:—

Lowestoft, Norwich	...	...	...	24 inches ¹
Canterbury	...	...	...	27 "
Hastings, Bath, Taunton	...	...	...	29 "
Ventnor, Llandudno	...	...	...	30 "
Cheltenham, Exeter, Dawlish, Clifton	...	...	...	32 to 33 "
Falmouth, Plymouth	...	...	...	40 "
South Wales	...	...	...	50 "
The North-West of England	...	...	...	50 to 60 "
Parts of Cumberland and Lakes	...	...	...	140 to 160 "

The duration of sunshine during the winter months compares also favourably with that recorded at Bournemouth and many places on the South Coast. The following statistics refer to the year 1895:—

BRIGHT SUNSHINE. 1895.

Place.	Hours.			Days of no Sunshine.		
	Oct.	Nov.	Dec.	Oct.	Nov.	Dec.
Corton (Lowestoft)	102	61	25	6	7	18
Geldeston (near Lowestoft) .	99	59	42	7	7	15
Bournemouth	99	51	34	9	9	14
Total of Quarter.			Total of Year.			
	Sunless		Sunless			
	Hours.	Days.	Hours.	Days.		
Corton (Lowestoft)	188	31	1691	59		
Geldeston (near Lowestoft) .	200	29	1783	51		
Bournemouth	184	32	1644	64		

In conclusion the following wind observations made by Mr. S. H. Miller, F.R.M.S., during the year 1896 may be recorded:—

N. to N.E. winds prevailed on	58 days.
E. to N.E. " " "	47 "
S. to S.W. " " "	92 "
W.N.W. " " "	139 "

Water Supply.—Lowestoft is supplied with water in part from the mains of the Lowestoft Gas and Water Company, and to a less extent from surface wells, these latter being most numerous in the older portions of the town.

The Water Company obtain their supply from the "Mill-water," an extension of Fritton Broad situated in the parish of Lound, and about seven miles distant from Lowestoft. The Company's Act empowers them to take water also from Fritton Broad itself, should the present source of supply become inadequate. The

¹ For further information on this point see pp. 127-129.

works of the Water Company are situated at the extreme south-west corner of the "Mill-water," and at a considerable elevation above it. The orifice of the pipe connected with the pumping engines is at a point opposite the works, and close to the water's edge on that side. From the lake water is pumped up to the filter-beds, six in number, of which four measure 70 feet by 40 feet, while two larger ones, which have been constructed quite recently, measure 120 feet by 80 feet.

The filtering material in each case consists of a layer of sand three feet in depth, below which are shallower layers of shingle and stones, the size of which increases in each layer from above downwards.

A not inconsiderable portion of the houses in the Borough, about 1,000, obtain their water not from the Company's mains, but from surface wells, generally within their own curtilages. In many instances these wells, the sides of which for the most part are by no means water-tight, are in proximity to privy middens, the floors and sides of which are seldom or never properly cemented. As a natural consequence, the intervening soil and eventually the contents of the well become fouled with organic matter of excremental origin, so as to render the well-water unfit for human consumption. That this is so has been shown repeatedly as the result of chemical analysis of the water drawn from these surface wells.

In a number of cases in which evidence of contamination of wells has been obtained, orders have been made for closing them and for the provision of a better water supply.

Drainage.—The town possesses a main drainage system, which is made up of three sub-divisions; two serving the area north of the harbour to be termed the northern and central system respectively, the third serving that portion of the town which is situated south of the river.

The sewers of these three systems all converge to a point called Lowestoft Ness, the easternmost spot in England, where they are supposed to discharge to the sea. The main sewer of the central system, which serves the greater portion of the old town, is built of brick and is 4 feet in diameter. The main sewer of the northern system is composed of 30-inch earthenware pipes, while the terminal portion of the sewer serving the south town is a

12-inch iron pipe. Formerly this latter used to open directly into the harbour, but in consequence of complaints as to the condition of the water in the harbour at certain periods, the sewer was continued by an invert under the harbour, and allowed to discharge into a pumping well on the north bank, whence the sewage was forced by means of ejector pumps on the same system to the outlet at the Ness point.

Prevalence of Disease.—In the last quarter of the year 1895 the Registrar-General's returns showed that during that period 57 deaths had occurred from measles and 8 from diphtheria in the Lowestoft sub-district of which the Borough of Lowestoft forms by far the greater part. During the last ten days of 1895 and in the month of January 1896 there were 16 cases of enteric fever in the Borough. The Local Government instructed Dr. S. Monkton Copeman to visit the town, and to make inquiry with special reference to the prevalence there of different forms of zymotic disease. The following statements are based on the Report of the Medical Officer of Health for the year 1896.

Measles.—During the third and fourth quarters of the year 1895, measles was prevalent in Lowestoft. The malady presented also a type of unusual virulence, no less than 75 deaths having been registered as due to this disease up to December 31st, 1895, this number representing a death-rate for the half-year of 2·94 per 1,000 of the total population.

Although the late Medical Officer of Health had advised the addition of measles to the schedule of diseases notified in the Borough, the Sanitary Committee had not, up to the time at which the epidemic commenced, considered it desirable to recommend the Town Council to adopt this course. In consequence it has not been possible to arrive at any accurate estimation of the total number of persons attacked by the disease, but the Medical Officer of Health puts it down as "several hundreds."

Previous to the appearance of the first cases of the disease in the autumn of 1895, no deaths from measles had been registered in the Borough for more than three years, from which it may fairly be inferred that, even though cases of the disease may have occurred during that period, they were at any rate comparatively few in number and of mild type. In consequence there would be

likely to be, at the time at which the outbreak at present under consideration first appeared, a considerable number of susceptible children among the population who would be liable to attack on coming into contact with the disease.

Although the disease had after its first introduction spread to a certain extent from house to house, it was not until the beginning of September that it obtained any serious hold on the population. This period corresponded with that at which the various schools re-opened after the summer vacation, subsequently to which time the gathering together in these establishments of numbers of children, some of whom though perhaps not known to be ill were yet in an infectious condition, would appear to have concluded in no small degree to the further and rapid spread of the disease.

Enteric Fever.—Of this disease forty cases were notified in 1895, during which year also eight deaths were registered as from this cause. Two of the cases were imported into the town: one from London, a school teacher, in whose case the malady had a fatal termination; the other a cooper from Scarborough. Of the 40 cases, 18 were removed to the Sanatorium for treatment, of whom two died. Six of these cases occurred in December 1895, and these were followed by ten more in January 1896. After careful investigation it was found impossible to define any condition other than such as are always present in the locality as responsible for this particular outbreak. Enteric fever was certainly for a time endemic in Lowestoft, as appears from a consideration of the fact communicated by the Medical Officer of Health, that the death-rate from this disease per 1,000 of the population was, in 1895, almost identical with the mean enteric fever death-rate for the previous eleven years, the figures being 0·476 and 0·483 respectively.

Diphtheria.—During the year 1895 the notifications of this disease numbered 46, of which no less than 30 occurred in the course of the last four months of that year. The number of deaths during the eight-months and four-months periods was 12 and 9 respectively. Although the numbers of both cases and deaths were unduly large, they did not attain the proportions which had been reached in each of the three immediately preceding years, there having been a sudden jump

from 15 cases with two deaths in 1891 to no less than 65 cases with 15 deaths in 1892.

Dr. J. E. O'Connor of Lowestoft states that the chief causes of death apart from zymotic diseases are bronchitis and pneumonia.

Anæmia is not common, and the bracing air agrees well with anæmic people.

Phthisis is rare amongst the native population. Imported cases of incipient phthisis do well, but the climate is not suited for cases of phthisis attended with hæmoptysis.

Nephritis and calculus are almost unknown.

Therapeutical Effect of the Climate.—The climate of Lowestoft is bracing, and it seems well adapted for anæmic and delicate children, and at certain times of the year for early cases of phthisis. An attempt has been made of late to urge its claims as a Winter Resort.

NORFOLK.

GREAT YARMOUTH.

The County Borough of **Great Yarmouth** consists of the parishes of Great Yarmouth and Gorleston. It covers an area of 3,524 acres, and contains a resident population of 51,250. The parish of Yarmouth occupies a sand-bank which stretches south from the south-east corner of Norfolk, and has the sea on its east side, the river Yare on its west, the harbour on its south, and the parish of Caister on its north where it joins the mainland. It is built on sand reclaimed from the bed of the ocean by the action of tides and wind. The sand is exceedingly porous, and water flows through the subsoil from the river and the sea when the tide is high. Thus there is an influx and efflux, an ebb and flow into the soil and out of it alternating with the tidal waters around.

Gorleston occupies higher ground, and stretches along the cliff west of the river and south of the harbour. Here the subsoil is dry and the ground water from 20 to 30 feet down.

The whole of the Borough is exposed to the east and north-east winds.

Meteorology.—The only information obtainable respecting the climatic conditions of Great Yarmouth is that afforded by the accompanying Table drawn up by the Rev. C. J. Stewart:—

TABULAR STATEMENT OF THE CLIMATE AND WEATHER OF GREAT YARMOUTH DURING THE YEARS 1880 TO 1889 INCLUSIVE.

MONTH.	TEMPERATURE OF AIR						Average number of days on which rain fell.	Average Rainfall.	Average Humidity.	Bright days			NUMBER OF DAYS.						
	Average mean Temp.	Highest Reading.	Lowest Reading.	Average of Maxima.	Average of Minima.	Prevailing direction of Wind.				1-7.	8-10.	Overcast days	Cold 40-49	Cold 30-39	Warm 60-69	Hot 70-79	Very Hot 80-89	90-99	
May	49.4	79.7	27.1	58.5	41.1	NE	11	1.771	83	163	14.7	4.9	16.8	10.4	1.9				
June	54.6	82.8	33.6	63.8	48.1	NE	10	1.480	82	15.0	14.1	..	8.4	15.8	5.6	0.3			
July	58.8	90.3	39.0	68.9	52.1	SW	15	2.635	80	15.1	15.9	..	0.8	17.9	10.8	1.4			0.1
Aug.	58.1	82.8	39.2	67.7	52.0	SW	12	2.024	80	13.4	15.6	..	1.4	19.0	9.7	0.9			
Sept.	55.6	75.2	33.9	63.4	49.8	SW	15	1.886	85	14.3	15.7	0.1	6.5	19.7	3.5	0.2			

The following is a summary of the climatic conditions which prevail at Great Yarmouth during the most popular months of the year. They are founded on observations made during the last ten years.

May has the greatest average number of "bright" days, rather more than half the total number falling into this category. But these "bright" days avail little against the cold wind whose prevailing direction is N.E. The evenings and nights are cold, the latter sometimes even frosty. Of the days about half are cool, a third warm, and the rest cold or hot. The number of warm days has varied from 19 in 1886 to 5 in 1880. The average number of days on which rain fell is 11: usually the rainfall is not heavy.

June. Though the prevailing direction of the wind is still N.E., and the number of "overcast" days is about the same as in May, there is a considerable increase in temperature, the nights being appreciably warmer. The average number of warm days is a third more than, and of hot days five times as many as in May, while the cool days are only half the number of those in the previous month, and the cold days disappear. This is a dry month, the amount of rainfall is, on the average, smaller, and the number of

days on which it falls fewer than in any of the five months under consideration. But it is seldom that warm summer weather lasts until after the longest day. In only one year, 1881, have there been 24 "bright" days, in most years the number varies from 16 to 18, while in three years out of the ten there were only 12 in the month.

In July and August the number of "bright" days is almost the same in each month, being slightly less than those in May and June. The greatest number is 20, the least 7, and in several years the number ranges from 16 to 17 in July. In August the number of "bright" days varies from 22 to 12; the usual number being the same as in July, 16 to 17. There have been more hot days in July than in August, but while the number of warm days in August exceed those of July, there is a slight increase of cool days. The nights are warm, the average of the lowest readings of the thermometer being appreciably above the mean temperature of May. In both these months more rain falls than in May or June; and in July rain occurs more frequently and in greater quantities than in August. On the other hand, the "relative humidity" or moisture of the air is less than in any other of the other five months, that is to say between the intervals of rain it is very dry, yet not so dry as to be unpleasant.

September has rather more than half its days overcast. In 1884 there were 20 bright days, but in 1887 only 7. The usual number is about 14. There is however more variation in the number of "bright" days in September than in other months. The number of warm days slightly exceeds the number in any of the preceding months, but the number of hot days is about only one-third of the number in July, while the cool days are five times as many, and the nights are distinctly colder. The prevailing direction of the wind is still S.W., but it brings the greatest average rainfall of the five months, on about 15 days, and the relative humidity increases. A considerable difference is usually felt between the temperature of the beginning and that of the end of the month. As a rule fine weather maintains during the first ten or fourteen days, after which the temperature decreases, rain falls more frequently and in larger quantity.

As a whole it may be said that the climate of Yarmouth is stimulating, invigorating and bracing, and especially suited to

persons whose health is impaired by overwork and nerve exhaustion. Yarmouth, however, has done nothing to tempt the chronic invalid, there being no winter garden or other resort for such cases when the breezes on the sea-front are too strong.

Drainage.—The drainage of the Borough is effected by an efficient system of sewers, and these are regularly flushed with sea-water: a separate service for that purpose and for sprinkling the roads is laid on throughout the district.

The Isolation Hospital is situated near the beach in the north part of the town, and has ample accommodation for typhoid, diphtheria and scarlet fever patients. That portion of the institution for the reception of those suffering from small-pox, cholera or plague is at Gorleston, within a mile of the harbour, but in the country surrounded by fields, and at a distance from any habitation or public road. Although rarely used, this rural hospital is complete in itself, having every convenience and accommodation and a separate staff. The parent institution has a Convalescent Home for scarlatina. At the Yarmouth and Gorleston Hospitals the Sanitary Authorities can provide over 100 beds, and in view of the enormous number of visitors and fishermen annually flocking to Yarmouth and the large quantity of shipping continually passing through the roadstead, it is not more than can be utilized.

Water Supply.—The water supply is in the hands of a private company whose works are at Ormesby, where they draw from the Broad. The service is constant, and the supply abundant.

The chief feature of Yarmouth is its beach, a wide stretch of sand extending many miles north and south. Along the sea-front some very extensive gardens have been recently laid out. These are well filled with grown shrubs and flowers, and afford a pleasant lounge. Those who go to Yarmouth for restoration to health would find the spring and early summer or autumn the seasons they would most appreciate. Yarmouth is evidently much too full in August to afford the room or quietness which sick people need.

It has been found impossible to obtain any official statistics relating to the presence of infectious diseases in Great Yarmouth, but undoubtedly many cases are imported. It must be remembered that there are probably over 200,000 visitors in the course of the

summer season, and as many as 95,000 excursionists have been known to visit Yarmouth in a single day.

CROMER.

Cromer is a pretty sea-side town in Norfolk, with a resident population in 1901 of 3,776, increased during the summer months to over 8,000. It faces the north, and the sun may be seen from the beach both rising and setting in the sea. On the south-east, Cromer gradually rises to an elevation of 260 feet, so that it is fully exposed to the north and east winds.

The soil is dry, the subsoil is first sand and gravel, then a deep bed of chalk. Half a mile to the west are large oak and pine plantations; shrubs only grow nearer the sea.

The rainfall is small, and with the exception of sea-fogs which are not frequent (perhaps a dozen in the year) the air is very dry. The amount of sunshine is distinctly above the average.

The following figures show the average maximum, minimum, and mean temperatures for the years 1885-1888:—

Average Max. Temp.		Average Min. Temp.		Mean Temp.	
1885	53·6	42·1		47·9	
1886	53·9	42·0		47·9	
1887	53·0	41·1		47·1	
1888	52·7	41·8		47·3	

The spring is very cold, owing to the prevalence of north-east winds, which last up to the end of May. July, August and September are generally warm and bright. The autumn and winter months, up till February, are exceptionally mild. Frost is rarely severe, indeed the gully-traps have been frozen once only during the past ten years.

The drainage is by water-carriage. Modern sewers exist, laid on concrete, well ventilated, with over 30 shafts besides those on buildings. Manholes are placed at all junctions, which are systematically inspected and flushed from large flushing-tanks and portable flushing-vans. The town water is conveyed in auxiliary sewers.

The roads are laid with tarred macadam.

The water supplied by the Water Company is derived from a well

223 feet deep, and 80 feet into the chalk. The chemical analysis shows it to be an admirable drinking water.

Prevalence of Disease.—Dr. Samuel Barton, the Medical Officer of Health, states that the residents are singularly free from *anæmia*; and cases of this disease sent there rapidly improve. *Scrophula* and *tubercular* diseases are rare, and convalescents from these diseases do well.

Phthisis is a considerable factor in the death-rate, and *hæmoptysis* is not uncommon.

In 1896, 1·6, and in 1897, 1·2, and in 1898, 1·1 per 1,000 population died of phthisis, but the residential population is so small that no conclusion can be drawn from these figures. The total number of deaths from phthisis in 1898 was only four.

Bronchitis is prevalent, especially in the spring.

Pneumonia, *pleurisy*, and *asthma* are rare.

Chronic albuminuria is fairly common both in the form of granular and large white kidney.

Calculus and *gravel* are not uncommon.

Acute rheumatism is common, but *rheumatoid arthritis* is infrequent.

Malarial affections are unknown.

Typhoid fever. There were no cases from January 1895 to December 1897. There were three in 1898, one of which was imported. Dr. Barton says:—"As I could not satisfactorily trace the origin of any of the three, and the water supply being above suspicion, I had some misgivings about the milk. On inquiry I found one large dairy had its milk supply by rail from various sources, some coming from the district of Bury."

Diarrhœa is common in summer.

Scarlet Fever and Diphtheria.—Seventy-nine cases of the former disease, and fourteen of the latter were notified during the last three years. These causes of illness have however materially decreased of late. Thus in 1898 only ten cases of scarlet fever and one of diphtheria were notified under the Act.

Endemic sore throat was uncommon until the summer of 1898, when there were many cases.

Common Causes of Death.—During the last three years the causes of death in order of frequency were as follows:—

1. Bronchitis. 2. Phthisis. 3. Heart disease. 4. Cancer. 5.

Renal diseases. 6. Diphtheria. During the three years nearly 40 per cent. of the deaths occurred in people over 65 years of age.

As Cromer has for some time past been steadily increasing in popularity as a bracing health resort, during the summer season, it has been found desirable to take special steps to guard against overcrowding. In December 1898 the following notice was issued and distributed to all householders:—

OVERCROWDING.

The Urban District Council having been informed of cases of overcrowding in Cromer during the season, consider it wise to inform all householders that 300 cubic feet of air space is the minimum amount for each human being in a sleeping apartment, and that anything less is a direct contravention of the laws of health, and will therefore have to be proceeded against as a nuisance.

Example.—A room 10 feet by 8 feet and 8 feet high would contain in the clear about 600 cubic feet of air space, and would therefore be the smallest size allowed as a bedroom for two individuals.

Householders can always obtain information as to the air space of any room by applying to the Sanitary Inspector.

To the east of Cromer are situated the little villages of **Overstrand, Sidestrand, Trimingham** and **Mundesley-on-Sea**. All possess a climate practically identical with that of Cromer itself, and all therefore enjoy the bracing air for which the former is now so famous.

At Mundesley it should be added a Sanatorium has recently been established for the open-air treatment of consumption, under the supervision of Dr. Burton-Fanning of Norwich.

WELLS-NEXT-THE-SEA.

Wells-next-the-Sea, to the west of Cromer, has a residential population of 2,494 persons. Although not actually on the sea it is a favourite summer resort, good accommodation for families being obtainable at very reasonable terms. The country in the immediate neighbourhood is flat, but within a mile and a half is Holkham Park, the seat of the Earl of Leicester, which is beautifully wooded and always open to the public. Along the coast to the west for many miles the sand-hills have been thickly

planted with fir-trees, which grow well and are now approaching maturity. The climate is very dry, and the rainfall is several inches below that of the average for England. In the spring east winds prevail, but the autumn is uniformly fine. There are no fogs and the air is bracing. The drainage is good, and there is a plentiful supply of pure water obtained from deep wells. The drains and sewers are periodically inspected and flushed, and the Inspector of Nuisances has instructions to report any instances of overcrowding which may occur in the poorer districts of the town.

Most of the inhabitants live to a great age, and there are many people in the district who are over ninety.

Cases of phthisis do well in the summer, but the prevalence of east winds in the early part of the year makes it an unsuitable place of residence for sufferers from chronic bronchitis.

HUNSTANTON.

Not many miles to the west of Wells lies **Hunstanton**. This little East Coast watering-place, situated on the Wash, presents the remarkable peculiarity of facing due west. Owing moreover to the formation of the ground, it is much protected from the north, and to a considerable degree from the east. As a result the air here, though bracing, is not so keen as in the great majority of East Coast health resorts, while in the spring the piercing east winds are much less severely felt.

Admirable golf links at old Hunstanton, about one mile from the modern watering-place, on the sand-hills adjoining the beach, add to the attractions of the neighbourhood.

LYNN, LYNN REGIS, or KING'S LYNN.

A few words may now be devoted to Lynn, and especially to the unusual prevalence of calculus in certain portions of the surrounding district.

Lynn is a seaport, and a municipal and parliamentary borough, in the County of Norfolk. It is about three miles from the mouth of the Great Ouse, and is forty-one miles west-north-west of Norwich. The residential population amounts to 20,289, and the chief

industries are ship-building and rope-making. Lynn is on the east side of Marshland and of the Great Level or Fen Country, and is intersected by three rivulets locally called Fleets. The district of Marshland consists of a tract of flat alluvial country of a triangular shape, bounded on the east by the river Ouse, on the west by the river Nene, and on the north by the Wash. It comprises an area of about 160 miles, the greater portion of which, almost within historic times, has been reclaimed from the sea. The population of about 16,000 people is purely agricultural. On the east side of the Ouse, excluding the townships of Lynn and Downham, there is an agricultural population of about 17,800.

The natural water supply of Marshland is surface water only, practically ditch, for there are no streams and very few wells. Of late years, however, this has been supplemented by rain-water stored in cisterns, and by the water supply to Wisbech, which is conveyed across the moors in an iron main, and of which the villagers through which it passes avail themselves. So impregnated is the soil with salt that few wells yield potable water. In many instances the water tastes so strongly of salt that it is undrinkable, but a fairly palatable water is obtained by mixing one pailful of well-water with two of rain-water. The following Table prepared by Mr. F. Sutton, F.C.S., of Norwich shows the percentage of chlorine in grains per gallon in various places on the west side of the river Ouse:—

				Chlorine grains per gallon.
Terrington St. Clement's	...	Post Mill Pulk	...	8.12
"	"	Road Side Pit	...	162.8*
"	"	Seaking's Well	...	67.2
Tilney All Saints	...	Savage's Well	...	110.6
"	"	Holborn's Pit	...	56.0*
"	"	Reeder's Well	...	36.4*
"	"	Gregory's Pit	...	10.08*
Tilney St. Lawrence	...	Peek's Well	...	33.6
Walpole St. Peter's	...	Stacey's Well	...	151.2*
"	"	Cozen's Well	...	129.3*
Walpole St. Andrew's	...	Road Side Ditch	...	1274.0*
"	"	Timble's Well	...	49.0
North Lynn	...	Clark's Well	...	127.4
West Lynn	...	Rayner's Well	...	36.4
"	...	Ellis' Well	...	22.4
Clenchwarton	...	Cotton Row Pit	...	10.64
"	...	Bartle's Pit	...	336.0

		Chlorine grains per gallon.
Elm	... .. Canal	319·2*
„	... .. Clamp Pits	11·2
Average		155·3

= 253·95 grains of salt per gallon.

Those marked with an asterisk are not used for drinking purposes.

The following is a similar Table, also prepared by Mr. Sutton, showing the amount of chlorine per gallon in the corresponding area on the east side of the river.

		Chlorine grains per gallon.
Watlington	... .. S. Nobbs' Well	8·40
„	... .. E. Moore's Well	3·60
West Bilney	... .. Paw's Cottages	3·60
„	... .. Back's Well	2·24
Runceton Holme	... .. Jerry's Well	7·80
West Winch	... .. Hunter's Well	3·00
Setchey	... .. Newell's Well	11·60
North Wootton	... .. The Run	2·20
Ashwicken	... .. Robert Smith's Well	1·40
Middleton	... .. Shawl's Well	2·80
King's Lynn	... .. Water Supply	2·20
Average		4·11

= 7·22 grains of salt per gallon.

Prevalent Diseases.—Dr. C. B. Plowright, Surgeon to the West Norfolk and Lynn Hospital and Medical Officer of Health, Freebridge Lynn Rural District, states that during the past twenty years there have been 3,926 deaths in the district, of which 286 or one in every 13·7 were due to *phthisis*. The annual death-rate for phthisis is 1·1 per 1,000 of the population living. Of these 286 cases, 28, or 10 per cent., contracted the disease elsewhere and came home to die. Most of these were either girls who left to take situations as domestic servants, or young men who migrated from the agricultural districts for more remunerative work in towns. It was found that the villages in which the disease was most prevalent were those situated on the Lower Green Sand. For example, in two villages on this formation the rate per 1,000 was 2·4 and 2·09, whilst in a village on the Boulder

Clay it was 1·7, and in another village on Marine Clay and Loam it was only 0·4. In three populous villages on Chalk Hills capped with Boulder Clay the mortality from this cause was only 0·9, 0·6 and 0·5 per 1,000 respectively. From this it would appear that the mere composition of the soil does not appear to affect the distribution of the disease so much as the fact of its being water-logged or not.

Calculus is extremely common in some districts, whilst others are practically free from it. Dr. Plowright has collected data respecting 1,936 cases in which the diagnosis was confirmed either by operation or by *post-mortem* examination. The great majority of these were met with in hospital practice, as will be seen from the following statistics:—

	Cases.
Norfolk and Norwich Hospital, 1772 to 1885	1,503
West Norfolk and Lynn Hospital, 1835 to 1885	124
Yarmouth Hospital, 1839 to 1874	72

In addition to these, 237 cases occurred in private practice. It has long been a matter of observation on the part of the surgeons of the Lynn Hospital that they seldom, if ever, have a stone case from Marshland, that is, west of the Ouse. Since 2865, 53 calculi have been added to the collection at this hospital; 50 of these cases came from the east side of the river, 3 only from the west. Of these 3, 1 was from Long Sutton, in Lincolnshire; 1 from Friday Bridge in Cambridgeshire; and 1 from Marshland, Terrington St. Clement's; this last was removed from a young child, whose parents had immigrated into Marshland, from High Norfolk, about a year before its birth.

In High Norfolk, that is east of the Ouse, one case occurs in every 2·5 square miles; while in Marshland, that is west of the river, one case occurs in every 8·2 square miles.

The limitation of the disease by the Great Ouse is a matter of considerable interest from an etiological point of view. Not only do the cases come quite up to the east bank of the river from Southery to Lynn, but they also come quite up to the coast from Lynn to Yarmouth. So much is this the case, that there is scarcely a village on the seaboard of the county in which one or more cases have not occurred; Hunstanton being one of the very few exceptions. On the southern boundary of the county the cases extend,

with little if any diminution in frequency, into the adjoining one of Suffolk.

In East Norfolk, the cases tend to follow the course of certain rivers, the Bure, the Waveney, the Tese, and the Ket. This is not observable with the rivers in other parts of the county.

Dr. Plowright found that excluding the large towns, Norwich and Great Yarmouth, 801 cases occurred upon the following formations:—

Postglacial ..	{	Alluvium ...	1
		River-gravel ...	20
Glacial Drift ...	{	Sand and gravel ...	189
		Gravel and sand ...	155
		Boulder-clay ...	149
Norwich Crag ...		Loam and sandy loam	245
Upper Chalk			12
			801

The rivers which the cases follow are those whose course is outlined by the Norwich Crag. Certain towns and villages are specially subject to the disease; for example:—

Population, 1881.		Number of Cases.
2,647 ...	Aylsham ...	23
1,090 ...	North Elmham ...	14
4,566 ...	Wymondham ...	21
470 ...	Binham ...	8

Others are exempt, or nearly so.

1,500 ...	Hunstanton ...	0
1,407 ...	Watton ...	0
3,264 ...	Downham ...	1

Adjoining villages sometimes vary considerably.

1,127 ...	Pulham St. Mary Magdalen ...	2
822 ...	Pulham St. Mary the Virgin ...	8

The village of North Wootton, since 1865, has had 1 case of lithotrity, 2 of lithotomy, 1 of urethral extraction, 1 of renal (uric acid), 3 of uric acid gravel = 8 cases.

Population, 1881.		Number of cases.
324 ...	North Wootton ...	8
197 ...	South Wootton ...	0
345 ...	Castle Rising ...	0
195 ...	Wolferton ...	1

The three last-named parishes surround North Wootton on three sides, the sea bounding it on the fourth. Moreover, of the eight cases above named, seven occurred in one group of houses using the same water supply.

Dr. Plowright, as the result of an exhaustive study of the subject extending over a period of very many years, is of opinion that calculus is rare amongst those who consume salt freely. He points out that chloride of sodium is known to prevent the coagulation of the blood, and the presumption is that it has a similar action with other colloids. In support of this view he quotes from Dr. Ord, who says that "Whatever tends to keep the colloids diffused will oppose the formation of calculus, for while mucus equally diffused does little more than round off the edges of the crystals, precipitated it at once becomes the bed of spheres and agglomerations of spheres."

The following are Dr. Plowright's conclusions:—

(1) That there exists in Norfolk a district (Marshland) in which calculus is much less common than in other parts of the country.

(2) That in Marshland the natural water supply contains a large proportion of salt.

(3) That calculus was relatively more common during the period of the salt tax than before or after.

(4) That the disease is rare amongst sailors who consume much salt.

(5) That it is more common amongst the children of the poor from whose dietary salt is almost absent, than amongst those of the middle and upper classes where this is not the case.

(6) That the disease is common in India where salt is taxed.

(7) That the presence of salt greatly increases the solubility of uric acid.

(8) That the consumption of salt by increasing thirst ensures a larger amount of fluid passing through the urinary tract, and therefore lessens the probability of calculus.

(9) That by keeping the colloids equally diffused salt tends to prevent the crystalline solids of the urine from agglomerating into calculi.

Respecting the prevalence of other diseases in Lynn and the adjacent districts there is little to be said.

Anæmia is common.

Malaria is now rarely met with

Gout is not common, and aneurysm is practically unknown.

It is not clear that Lynn or its neighbourhood is specially adapted to the treatment of any particular class of ailments.

LINCOLNSHIRE.

The chief health resorts to be found in Lincolnshire are situated, with the single exception of Woodhall Spa, already described in the previous volume of this work, on the sea-coast. They are four in number—**Cleethorpes, Mablethorpe, Sutton-on-Sea,** and **Skegness.** A detailed description of them seems however to be unnecessary in this Report. All possess, it is true, the advantages to be derived from a low rainfall, together with a keen invigorating air. All too possess remarkably broad and firm sandy beaches permitting of excellent bathing. In themselves therefore in the summer months, in spite of the flat uninteresting nature of the surrounding country, they would have much to recommend them. Owing, however, to the enterprise of the railway companies innumerable excursionists from the Midland Counties, and even from Yorkshire and Lancashire, are brought to them each day throughout the summer, thus destroying the privacy of the neighbourhood, and rendering the places unsuitable for invalids. In the spring on the other hand when excursionists are not so frequent, the piercing east winds are very severely felt.

THE CLIMATE OF THE MIDLAND COUNTIES

By P. HORTON-SMITH, M.D., F.R.C.P.

PART I

GENERAL CONSIDERATIONS CONCERNING THE DISTRICT AND ITS CLIMATE

THE portion of England dealt with in the present article is superficially a very large one. Under this heading indeed no less than twenty counties are included, ranging from Cheshire and Derbyshire in the north to Wiltshire and Berkshire in the south, and from Shropshire and Hereford in the west to Cambridgeshire in the east. The "Midland Counties" in fact, for the purposes of this article, have been made to include all those which possess no true coast-line of their own, but are separated from the sea-board by intervening shires. The term "Inland" would perhaps have expressed more accurately the area now under consideration.

But although the district itself is thus a very large one, it will be unnecessary for the most part to treat it with the same detail that has been expended upon the sea-bordering counties, since the health resorts in the inland counties are but few in number. Before, however, proceeding to describe the latter, a few general considerations concerning the district, bearing upon its meteorology, climate and general health, may not be out of place.

Configuration of the District.—As regards configuration, it may be stated that the district, though for the most part merely undulating, nevertheless presents within its limits at least four definite ranges of hills, each of them of very different geological formation. Thus, in Gloucestershire we find the Cotswolds, belonging to the Oolitic series of rocks; in Oxfordshire and Buckingham-

shire the chalk hills or Chilterns; in Derbyshire the limestone mountains, forming the so-called "Peak District"; while lastly, separating the counties of Hereford and Worcester, come the rocks of igneous formation, known by the name of the Malvern Hills.

In addition to these well-known ranges certain minor elevations also exist. Among these the most important are the Long Mynd and its adjacent hills in South Shropshire, the Chalk Downs in Wiltshire and Berkshire, the Edge Hills in Warwickshire, and lastly the high ground around Naseby in the adjoining county of Northampton, the latter of interest from the fact that it constitutes the watershed of Central England.

With these chief exceptions, however, the remainder of the district, excluding the absolutely flat fen land of Cambridgeshire, may broadly be spoken of as undulating in character.

Elevation.—As might be expected, most marked differences in elevation are to be met with in the district. In Gloucestershire, on the estuary of the Severn, and again in the Fen district of Cambridgeshire, sea-level is reached, or in the latter even surpassed. In the Peak district of Derbyshire on the contrary a height of 2,000 feet is attained. Between these extremes all variations of altitude are encountered. With the exception, however, of the chief elevations mentioned above, the whole of the district considered in this article has an elevation of something under 400 feet, the latter figure roughly representing the altitude of the high ground in the centre of England, in the Leicestershire neighbourhood, whence there is a gradual fall both east and west.

Geology.—The geology of the district presents certain points of general interest, to which attention may now be drawn. In the first place it should be noticed that the counties now under consideration are chiefly composed of four different groups of rock. Passing from east to west these are as follows:—1. The Chalk and its allied formations; 2. the Oolitic formations and the Lias, constituting the so-called Jurassic series; 3. "The New" and 4. "The Old" Red Sandstone. These form roughly parallel strata, running diagonally across the country from south-west to north-east.

In connection with these various strata certain facts strike one. Thus it should be noticed as regards the chalk, how wide is the

area over which this formation is distributed in the Midland counties. It is not by any means, as is sometimes assumed, restricted merely to Wiltshire. On the contrary it is responsible for large portions of Berkshire, Oxfordshire, Buckinghamshire, Bedfordshire and Cambridgeshire, as well as almost the whole of Hertfordshire. This point is of some importance to bear in mind, for where the chalk is, there will almost certainly be a low degree of humidity.

The second group, the Jurassic series, forms parallel deposits interposed between the New Red Sandstone and the Chalk, and as a result enters largely into the formation of Gloucestershire, Oxfordshire, Buckinghamshire, Bedfordshire, Huntingdonshire and Leicestershire, while Northamptonshire and Rutland belong entirely to these strata. The wide area occupied by these rocks is again of importance to bear in mind, for owing to the clayey nature of the soil, produced by the Lias and by certain of the Oolitic formations, the regions so constituted are apt to be damp.

Coming lastly to the Red Sandstone, it may be noted that the New Red Sandstone enters largely into the formation of the true Midland, as well as the North Midland counties, while the Old Red Sandstone composes a large portion of Gloucestershire, as well as almost the whole of Herefordshire. Of themselves these formations will tend to produce a dry climate, and in certain of the counties, notably perhaps Nottinghamshire, this is what we find. In others, however, especially towards the west, this tendency is somewhat counteracted by the heavy rainfall, and also by the fact that, in certain places at least, the sandstone has been covered by a layer of drift clay.

Meteorology.—If we bear in mind the wide area with which this Report deals it will be evident that any general statement made concerning the climate can only be true in a broad sense, and must not be taken as applying necessarily to every individual locality situated within the district. This fact should not be forgotten in reading the following pages.

Taking the district as a whole, however, certain points stand out. In the first place it should be noted that the region now being considered possesses a climate which differs from that of the sea-coasts, upon which the majority of English health resorts are situated, in certain material features.

Thus, owing to the absence of the equalizing influence of the sea, the Midlands, and Inland Counties in general, are both hotter in summer and also colder in winter than the sea-coast stations. They show in addition a slightly greater daily range of temperature, and, owing to the fact that clouds are more prevalent inland, their average sunshine record is somewhat inferior.

These points, though accepted now by meteorologists, and drawn attention to especially by Mr. Campbell Bayard in his interesting paper on "English Climatology,"¹ are not perhaps as yet matters of common knowledge. It may be of value therefore to emphasize them by the following Tables. For certain of the figures, those from the sea-coast stations in particular, the writer is indebted to Mr. Bayard's paper.

1. **Temperature.**—The following figures show the mean temperature, and also the mean minimum temperature, during the months of December, January and February, the coldest quarter of the year, at (*a*) the Midland stations, (*b*) certain typical and well-known sea-side health resorts:—

TABLE I.

SHOWING THE AVERAGES OF THE MEAN MINIMUM TEMPERATURES, AND ALSO OF THE MEAN TEMPERATURES, FOR THE MONTHS OF DECEMBER, JANUARY AND FEBRUARY, 1881-1890.

<i>Inland (Midland) Stations.</i>			<i>Sea-coast Stations.</i>		
	Mean Min. Temp.	Mean Temp.		Mean Min. Temp.	Mean Temp.
Norwood	34·1	38·7	Scilly	42·6	45·8
Regent's Park	34·0	38·7	Guernsey	40·1	43·6
Ross	33·4	38·7	Falmouth	39·6	43·5
Burghill	32·9	38·5	Ventnor	37·8	41·9
Cheltenham	32·7	38·0	Teignmouth . . .	37·3	41·9
Belper	32·4	37·1	Weymouth	37·3	41·5
Macclesfield	32·4	37·1	Sidmouth	36·4	41·0
Strathfield Turgiss .	32·3	38·0	Brighton	35·7	40·5
Marlborough	32·3	37·5	Worthing	35·1	39·5
Kenilworth	32·3	37·2	Margate	35·1	39·3
Hodsock	32·1	37·7	Ramsgate	34·7	39·2
Apsley Guise	32·1	36·9	Portsmouth . . .	34·6	39·7
Cheadle	32·0	36·6	Southampton . .	33·1	38·8
Buxton	30·1	35·2			

From this Table it will be seen most clearly that, so far from the sea-coast being colder in winter than the Midland stations, as is often supposed, it is the latter which in every case (with the solitary exception of Southampton) show the lower readings. Thus,

¹ *Quarterly Journal of the Royal Meteorological Society*, vol. xviii., No. 84, October 1892.

taking the mean minimum temperatures, the sea-coast stations range from $42\cdot6^{\circ}$ at Scilly to $34\cdot6^{\circ}$ at Portsmouth (Southampton $33\cdot1^{\circ}$). The Inland and Midland stations on the contrary range from Norwood, $34\cdot1^{\circ}$, to Buxton, $30\cdot1^{\circ}$. An identical condition of affairs also is revealed by an inspection of the mean temperatures during the similar period.

The Inland stations are therefore colder in winter than those situated on the sea-coast.

If however we now pass from the winter to the summer months, we find the opposite to be the case. Thus, taking the months of June, July and August, on an average the three hottest months of the year, and comparing the same stations as before, we obtain the following result:—

TABLE II.

SHOWING THE AVERAGE MEAN MAXIMUM TEMPERATURES DURING THE MONTHS OF JUNE, JULY AND AUGUST, 1881-1890.

<i>Inland (Midland) Stations.</i>	<i>Sea-coast Stations.</i>
Strathfield Turgiss $70\cdot6$	Portsmouth $69\cdot7$
Norwood $69\cdot8$	Southampton $69\cdot1$
Ross $69\cdot8$	Ramsgate $67\cdot5$
Regent's Park $69\cdot7$	Teignmouth $67\cdot1$
Burghill $69\cdot2$	Margate $66\cdot8$
Apsley Guise $68\cdot4$	Brighton $66\cdot7$
Cheltenham $68\cdot2$	Ventnor $66\cdot6$
Marlborough $67\cdot6$	Worthing $66\cdot3$
Hodsock $67\cdot5$	Weymouth $65\cdot8$
Kenilworth $67\cdot2$	Guernsey $65\cdot6$
Belper $65\cdot8$	Sidmouth $65\cdot0$
Macclesfield $65\cdot0$	Falmouth $64\cdot6$
Cheadle $64\cdot4$	Scilly $63\cdot1$
Buxton $64\cdot0$	

From these figures it will be seen that, *if we exclude the mountainous stations of Buxton, Macclesfield and Cheadle*, which have naturally much lower temperatures, and also Portsmouth and Southampton, which in many ways are peculiar, practically all the inland stations show a higher mean maximum summer temperature than do those on the sea-coast. *The former therefore, though colder in winter, are also hotter in summer.*

2. Daily Range of Temperature.—Concerning the daily variation in temperature it has been stated that in the Midlands the daily range is somewhat greater than that observed on the sea-coast, and this point is well brought out by the following figures:—

TABLE III.
SHOWING THE AVERAGE DAILY RANGE OF TEMPERATURE THROUGHOUT
THE YEARS 1881-1890.

<i>Inland Midland Stations.</i>		<i>Sea-coast Stations.</i>	
Strathfield Turgiss	16·6	Southampton	15·7
Burghill	15·6	Portsmouth	14·0
Ross	15·3	Ramsgate	12·0
Marlborough	15·1	Teignmouth	11·8
Hodsock	15·0	Worthing	11·6
Cheltenham f		Brighton	11·5
Apsley Guise	14·4	Sidmouth	11·4
Kenilworth }	14·1	Weston-super-Mare	11·2
Norwood f		Margate	10·9
Buxton	13·9	Ventnor	10·6
Regent's Park	13·7	Weymouth	10·3
Belper	13·0	Falmouth	9·4
Cheadle }	12·6	Guernsey	9·2
Macclesfield f		Scilly	7·1

From these data it is clear that, excluding Southampton and Portsmouth, which in this respect also behave like inland stations, every one of the sea-coast stations show a smaller daily range than was observed in the Midland counties. In general the difference is not great, amounting to not more than 3 or 4 ; but if the two extremes be compared, Strathfield Turgiss (16·6) and Scilly (7·1), then the difference in daily range will be found to reach the comparatively high figure of 9·5°.

3. **Cloud.**—The following figures (Table IV.) show that the average amount of cloud at 9 a.m. is slightly greater in the inland counties than on the sea-coast, possibly, as Mr. Bayard suggests, because the sea-breezes disperse the mist earlier than can be effected inland. The difference at the early hour of the day at which the observations are taken, is in truth not marked, the average figures for the inland and sea-coast stations being 6·9 and 6·5 respectively. There is no doubt, however, that *throughout the day* the inland stations *are* more cloudy than those situated on the sea-coast, for this indeed is proved by the diminished amount of sunshine recorded at the former. This excess of cloud, thus observed in the Midland counties, is doubtless to be explained by the fact that “the sea-coasts are low as a rule, and clouds form inland when the ground rises into hills.”¹

¹ *Ten Years' Sunshine in the British Isles, 1881-1890*, published by the authority of the Meteorological Council, 1891.

TABLE IV.

SHOWING THE MEAN AMOUNT OF CLOUD (0—10) AT 9 A.M. THROUGHOUT THE YEARS 1881—1890.

<i>Inland (Midland) Stations.</i>		<i>Sea-coast Stations.</i>	
Buxton	7·3	Sidmouth	7·2
Kenilworth	7·3	Weston-super-Mare	7·0
Marlborough	7·2	Falmouth	6·9
Burghill	7·0	Margate	6·9
Cheltenham	7·0	Southampton	6·8
Hodsock	7·0	Teignmouth	6·8
Strathfield Turgiss	7·0	Ramsgate	6·7
Apsley Guise	6·9	Guernsey	6·6
Cheadle	6·9	Ventnor	6·1
Norwood	6·9	Portsmouth	6·0
Ross	6·4	Worthing	5·9
Macclesfield	6·6	Weymouth	5·4
Average	6·9	Average	6·5

4. **Sunshine.**—It has been stated that the amount of sunshine recorded in the Midland counties is somewhat inferior to that experienced at the sea-coast stations around. This point is well brought out in the following Table V. (p. 126), in which the total amount of sunshine or rather sun-heat (the Campbell-Stokes instrument having been used) at thirty-two stations in the British Isles is tabulated, the order of the stations proving practically the same even if corrections for the varying latitude of the different localities be allowed for. Thus it will be seen from the Table that the ten stations with the greatest record of sunshine are all, with the exception of Geldeston in Norfolk, sea-coast stations. Geldeston itself however lies not far from the coast. The remaining stations are, with three exceptions, all situated inland.

With regard to the eight Midland stations themselves, the following is their order arranged according to their sunshine record:—

	Hours of Sunshine.	% of possible Sunshine.
Cambridge	1483·3	31·7
Oxford	1435·4	30·4
Cirencester (Glos.)	1422·4	30·3
Apsley Guise (Beds.)	1385·9	29·6
Marlborough (Wilts.)	1375·3	29·0
Worksop (Notts.)	1227·3	26·1
Leicester	1222·2	25·6
Strelley (Notts.)	1208·5	25·6

It will be noticed that the most sunny is Cambridge, and the

TABLE V.

SHOWING THE MEAN ANNUAL SUNSHINE AT THE FOLLOWING STATIONS DURING THE YEARS 1881-1890.

	Total Annual Hours of Sunshine.		Total Annual Hours of Sunshine.
1. ¹ St. Aubin's, Jersey	1864·8	17. Kew	1399·1
2. St. Leonards 1886-1890 = 8428 hrs.	1685·6	18. Aberdeen	1394·3
3. Falmouth.	1668·9	19. * Apsley Guise (Beds.)	1385·9
4. St. Ann's Head, Mil- ford Haven	1635·5	20. * Marlborough (Wilts.)	1375·3
5. Ventnor 1886-1890 = 8126 hrs.	1625·2	21. Parsonstown (King's Co. Ireland)	1361·5
6. Geldeston (Norfolk)	1619·1	22. Stonyhurst (Lancs.)	1288·9
7. Southampton	1590·7	23. * Worksop (Notts.)	1227·3
8. Douglas (Isle of Man)	1557·4	24. Greenwich	1226·9
9. Southbourne (Hants.)	1550·8	25. York	1223·0
10. Valencia (co. Kerry)	1483·4	26. Markree (co. Sligo)	1222·7
11. * Cambridge	1483·3	27. * Leicester	1222·2
12. Dublin	1468·5	28. Armagh	1220·5
13. Glynde (Lewes, Sussex)	1439·1	29. * Strelley (Notts.)	1208·5
14. Hillington (Norfolk)	1437·4	30. Sandwick-Swanbister (Orkney Islands)	1145·5
15. * Oxford	1435·4	31. Glasgow	1056·8
16. * Cirencester (Glos.)	1422·4	32. ¹ London (Bunhill Row)	1027·2

(Compiled from *Ten Years' Sunshine in the British Isles*, published by the authority of the Meteorological Council, 1891.)

¹ The highest and lowest totals recorded within the United Kingdom.

* The stations marked with this asterisk (*) are those situated in the Midland Counties.

least so Strelley in Nottinghamshire; the total number of hours of bright sunshine being throughout the year 1483 and 1208 respectively.

It should be borne in mind also that Cambridge itself enjoyed 381 hours less annual sunshine than did St. Aubin's in Jersey, where the maximum of actual possible sunshine (39·9 p.c.) in the United Kingdom is recorded, while Strelley was favoured with 181 hours in excess of that registered at Bunhill Row, in the City of London, the least sunny spot within the British Isles.

5. **Humidity.**—Concerning humidity, that is to say, merely the average humidity of the air at 9 a.m. and *not* the average humidity throughout the 24 hours, nothing definite can be stated. The following Table shows that the variations observed in the Midland counties are practically the same as those also found obtaining at the various sea-side stations :—

TABLE VI.

SHOWING THE MEAN RELATIVE HUMIDITY, AT 9 A.M., THROUGHOUT THE YEARS 1881-1890.

<i>Inland (Midland) Stations.</i>		<i>Sea-coast Stations.</i>	
Norwood	80 %	¹ Llandudno	79 %
Regent's Park	80·9 „	Weymouth }	80 „
Hodsock	81·2 „	Brighton }	80 „
Ross	81·6 „	Southampton }	81 „
Apsley Guise	82·8 „	Ventnor }	81 „
Burghill	82·8 „	Ramsgate }	82 „
Kenilworth	83·0 „	Margate }	82 „
Cheltenham	83·2 „	Teignmouth }	82 „
Marlborough	84·0 „	Falmouth }	83 „
Buxton	85·0 „	Worthing }	83 „
Macclesfield	85·4 „	Portsmouth }	83 „
Belper	85·6 „	Sidmouth }	85 „
¹ Cheadle	85·9 „	Guernsey }	85 „
		Seilly }	

¹ The lowest and highest figures recorded at any station within the British Isles during this period.

It will be seen from the above data that the statement made earlier is abundantly justified. *The Inland counties of England are colder in winter and hotter in summer than the sea-coast stations, the climate of which is rendered more equable through the influence of the sea. The daily range of temperature too in the former is somewhat greater, while, through their atmosphere being more cloudy, they also enjoy a somewhat smaller percentage of sunshine.*

6. **Rainfall.**—The following Table, summing up the returns from seventy-four stations during the decennium 1881-1890, shows clearly the annual rainfall in the Midland counties during

this period. It would seem too from a comparison with the accompanying Rainfall Map, constructed by Dr. Alexander Buchan, F.R.S.,¹ that the years in question offer an approximately accurate record of the true mean rainfall of the district.

TABLE VII.

SHOWING THE AVERAGE RAINFALL IN INCHES FOR THE VARIOUS INLAND COUNTIES DURING THE YEARS 1881—1890.

(Deduced from the *Rainfall Tables of the British Isles*, 1897, published by the authority of the Meteorological Council.)

Derbyshire	40·23 in.	Berkshire	26·36 in.
Cheshire	31·84 „	Northamptonshire	26·33 „
Wiltshire	30·79 „	Rutlandshire	25·87 „
Shropshire	30·73 „	Hertfordshire	25·86 „
Hereford	29·93 „	Oxfordshire	25·45 „
Gloucestershire	29·93 „	<i>Regent's Park</i>	25·11 „
Staffordshire	28·96 „	Nottinghamshire	24·44 „
Warwickshire	27·07 „	Huntingdonshire	23·58 „
Worcestershire	26·75 „	Bedfordshire	22·92 „
Buckinghamshire	26·70 „	Cambridgeshire	22·60 „
Leicestershire	26·68 „		

It will be seen from the figures that, if we exclude Derbyshire, the heavy rainfall of which is attributable solely to its northern or mountainous portion, the rainfall of the counties diminishes gradually as we pass from west to east. It reaches thus in Cheshire a maximum of 31·84 in., and in Cambridgeshire a minimum of 22·60 in. The average fall at Regent's Park, it may be added, amounted to 25·11 in. during the similar period.

This variation in the rainfall is in accordance with the well-known fact that the chief rain-bearing winds come from the west, and that therefore before they reach the Eastern Counties they have, as a rule, already deposited their excess of moisture. Hence the rainfall of the latter is considerably smaller than that experienced in counties situated further to the west.

7. Number of Rainy Days.—As regards the number of rainy days occurring in each year at the various stations, a glance at Table VIII. affords some information, though it is notorious how these particular returns are affected by the individuality of the different observers.

¹ See *Bartholomew's Physical Atlas*, Vol. III., Plate 23 (Constable and Co., 1899). This map, however, though more accurate in detail, does not differ fundamentally from the original *Rainfall Map of the British Isles*, produced by the late Dr. Symons, F.R.S., and published in *Modern Meteorology*, Edward Stanford, London, 1879.

After Alex^r Buchan, F.R.S.

After Alex^r Buchan, F.R.S.



TABLE VIII.

SHOWING THE AVERAGE NUMBER OF RAINY DAYS THROUGHOUT THE YEAR, TOGETHER WITH THE MEAN ANNUAL RAINFALL IN INCHES, AT THE VARIOUS MIDLAND STATIONS, DURING THE TEN YEARS 1881-90.

	Days.	In. Rain.
Buxton (Derby.)	195·5 . .	49·31
Cheadle (Staff.)	195·0 . .	31·83
Ross (Heref.)	194·1 . .	29·88
Macclesfield (Cheshire)	191·9 . .	34·60
Cheltenham (Glos.)	189·9 . .	27·50
Marlborough (Wilts.)	185·5 . .	30·70
Hodsock (Notts.)	182·0 . .	24·39
Belper (Derby.)	178·2 . .	31·56
Kenilworth (Warwick.)	177·1 . .	26·96
Burghill (Heref.)	173·5 . .	25·38
Apsley Guise (Beds.)	166·3 . .	23·44
Regent's Park	164·8 . .	25·17

From the figures it will be seen that, taking an average, rain fell on 184 days in every year at the 11 Midland stations, the actual numbers varying between 195 at Buxton and 166 at Apsley Guise (Beds.). At Regent's Park the similar figure was 163.

Comparison of the various Midland Stations: their climate contrasted with that of London.—So far then the general climatological features of the Inland Counties have been alone considered. Let us now turn to the individual stations themselves, and compare their several climates, and at the same time contrast them with that of London.

In the first place it will be seen (cf. Tables II. p. 123, and IX. p. 130) that, although *the Midland stations are hotter in summer than those situated on the sea-coast, yet with one exception they are not as hot as London.*

Thus the mean maximum temperature at Regent's Park during the three hottest summer months—June, July and August—of the years 1881-1890 was 69·7°. With the exception of Ross, in the warm western county of Hereford, which reached an average of 1° higher, 69·8, every Midland station showed somewhat lower readings. It may be added too that the figures at Regent's Park are not exceptional, for Norwood attained an average maximum of 69·8, thus equalling the temperatures recorded at Ross.

It is doubtful whether this exceptional heat of London during the summer months, surpassed in England only by the temperatures registered at Ross in Herefordshire and Strathfield Turgiss in Hampshire, is fully recognized.

TABLE IX.

SHOWING THE CHIEF POINTS OF INTEREST IN THE CLIMATOLOGY OF THE MIDLAND COUNTIES.

	Years to which the following data refer.	Mean Min. Temp. Dec. - Feb.	Mean Temp. Dec. - Feb.	Mean Max. Temp. June - Aug.	Mean Temperature June - Aug.	Mean Daily Range through- out Year.	Mean Humidity. (a.m.)	Rain, in inches.	Rainy Days.
1. Regent's Park .	1881-90	34.0	38.7	60.7	61.0	13.7	80.9	25.1	164
2. Ross (Hereford.)	1881-90	33.4	38.7	69.8	60.1	15.3	81.6	29.8	194
3. Burghill (Here- ford.) . . .	1881-90	32.9	38.5	69.2	59.5	15.6	82.8	25.3	173
4. Cheltenham (Glos.) . . .	1881-90	32.7	38.0	68.1	58.9	15.0	83.2	27.5	189
5. Belper (Derby.)	1881-90	32.4	37.1	65.8	57.9	13.0	85.6	31.5	178
6. Macclesfield (Cheshire.) .	1881-90	32.4	37.1	64.9	57.3	12.6	85.4	34.6	191
7. Kenilworth (Warwick.) .	1881-90	32.3	37.2	67.2	58.5	14.1	83.0	26.9	177
8. Marlborough (Wilts.) . .	1881-90	32.3	37.5	67.6	58.2	15.1	84.0	30.7	185
9. Hodsock (Notts.) . .	1881-90	32.1	37.7	67.5	58.4	15.0	81.2	24.2	182
10. Apsley Guise (Beds.) . . .	1881-90	32.1	36.9	68.4	59.2	14.4	82.8	23.4	166
11. Cheadle (Staffs.)	1881-90	32.0	36.6	64.4	56.7	12.6	85.9	31.8	195
12. Buxton (Derby.)	1881-90	30.1	35.2	64.0	55.4	13.9	85.0	49.3	195
13. Cambridge .	1871-95	31.5	37.7	70.5	60.7	16.7	85.6 ¹	23.29	
14. Oxford . . .	1871-95	33.6	38.6	68.5	60.3	13.9	85.1 ¹	25.72	
15. Loughborough (Leicester.)	1871-95	32.3	38.0	70.0	60.6	15.8	85.8 ¹	25.85	
16. Malvern (Worc.)	1891-97	33.7	38.2	68.2	60.3	12.8	80.4	26.1	164

¹ These figures refer to the years 1884-1887 only.

Although then London is hotter in summer than nearly all the Midland stations, it must now be added that in winter it reaps an advantage, for both in mean minimum temperature, and practically in mean temperature as well (cf. Table I. p. 122), during the coldest quarter of the year (December—February) it stands ahead of all the other inland stations.

The Midland and Inland stations in general then are cooler than London in summer, but colder than the latter in winter.

Turning now to a comparison of the Midland stations one with another (cf. Table IX. p. 130), it will be seen that the hottest in summer (and also the least cold in winter), are the two stations in Herefordshire, namely Ross and Burghill. With slightly lower temperatures follow the stations of Apsley Guise, Cheltenham, Hodsock, Marlborough and Kenilworth, while cooler still come the hill stations of Cheadle and Macclesfield, the two last-named indeed enjoying summer temperatures considerably *lower* than those of the great majority of sea-coast stations. Buxton finally closes the list. The latter in fact, while possessing a pleasantly low temperature in summer, rightly enjoys the reputation of being the coldest place in England during the winter. Thus its mean minimum temperature is 30·1° during the winter quarter of the year, or 1·9° lower than that of Cheadle, the station which in respect of winter-cold stands next it on the list.

Setting aside, however, Buxton, and the two stations in Herefordshire, it is worthy of notice how closely the mean minimum temperatures of all the remaining Midland stations approximate each other, during the first or coldest quarter of the year. Thus Cheltenham, Macclesfield, Belper, Marlborough, Kenilworth, Hodsock, Apsley Guise, and Cheadle, stations widely separated and most markedly different in their surroundings, though varying somewhat in their mean maxima, nevertheless all show during the winter quarter of the year average minimum temperatures ranging merely from 32·0°–32·7°.

Concerning daily range of temperature, the Midland stations do not differ markedly among themselves. Cheadle and Macclesfield, two hill stations, show the minimum range (12·6°), while the maxima (15·6° and 15·3°) are recorded by the two Herefordshire stations, Burghill and Ross. Between these limits will be found the daily ranges of all the other Midland stations (cf. Table III. p. 124).

Climatological Conclusions.—Such then are the most important characteristics of the climate of the Midland Counties. To recapitulate briefly—

They are hotter in summer and colder in winter than the sea-coast stations; they are rather more cloudy, and consequently somewhat less sunny; and lastly their daily range of temperature is slightly greater. Compared with London, though colder in winter, they are, with the exception of Herefordshire, not so hot in summer. As regards rainfall, counties to the west receive a heavier, those to the east a lighter fall.

General Health of the District.—It may be of interest now to refer briefly to the general health of the district, and to the incidence therein of certain important diseases.

Concerning the salubrity of the various counties dealt with in this article, certain information may be gathered from the figures recently published in the very valuable Supplement to the Fifty-fifth Annual Report of the Registrar-General. It should be added too, that these data acquire for our present purpose a special interest, since they refer to the decennium 1881–1890—the very period, that is to say, during which the climatology of England has been investigated for the purposes of this work.

The following figures (see Table X. p. 133), abstracted from Dr. Tatham's Report show the death-rate in standard population of each of the English counties.

From the Table it will be seen that, with the exception of Nottinghamshire, Warwickshire, Cheshire and Staffordshire, each of which contains large manufacturing centres, *all the remaining Midland counties show a death-rate lower than the average for England and Wales.* This is perhaps what might be expected, for owing to the rural nature of the majority of these counties the inhabitants are spared the dangers which inevitably attend the unhealthy occupations and overcrowding so constantly to be met with in great manufacturing towns.

Passing now to a comparison amongst themselves of the death-rates of the various Midland counties, it will be seen that, contrary to expectation, Huntingdonshire shows the lowest corrected death-rate of any county in England, and presumably therefore, so far at least as its inhabitants themselves, as opposed to visitors, are concerned, it must be considered the most healthy. At no great

distance from it however comes Rutlandshire, and then after an interval other Midland counties follow. Among the latter it may be noticed how satisfactory is the health of Hertfordshire, Buckinghamshire, Oxfordshire, Berkshire, (Surrey, Kent and Essex,) counties which border closely upon London. Their death-rates (on the average 15·47) bear eloquent testimony to the general salubrity

TABLE X.

MEAN ANNUAL DEATH-RATES PER 1,000 PERSONS LIVING IN REGISTRATION COUNTIES DURING THE TEN YEARS 1881-90, SHOWING THE DEATH-RATES IN STANDARD POPULATION.¹

Counties in Order of Standard Death-rate.	Death-rate in Standard Population.	Counties in Order of Standard Death-rate.	Death-rate in Standard Population.
England and Wales . . .	19·08	Essex	16·32
Huntingdonshire	13·94	Devonshire	16·56
Rutlandshire	14·20	Middlesex	16·62
Dorsetshire	14·24	Worcestershire	16·66
Westmoreland	14·32	Gloucestershire	16·89
Sussex	14·94	North Wales	17·06
Wiltshire	14·95	Cornwall	17·18
Hertfordshire	15·01	North Riding	17·67
Berkshire	15·02	Derbyshire	17·88
Oxfordshire	15·15	Leicestershire	17·92
Buckinghamshire	15·26	Cumberland	17·95
Suffolk	15·29	South Wales	19·04
Cambridgeshire	15·40	Nottinghamshire	19·13
Hertfordshire	15·41	East Riding	19·14
Somersetshire	15·50	Warwickshire	19·25
Shropshire	15·51	Cheshire	19·43
Surrey	15·58	Monmouthshire	19·53
Norfolk	15·58	Staffordshire	19·99
Kent	15·94	Northumberland	20·19
Lincolnshire	15·94	Durham	20·57
Hampshire	16·00	West Riding	21·23
Northamptonshire	16·21	London	21·42
Bedfordshire	16·30	Lancashire	24·19

¹ (Abridged from the *Supplement to the Registrar-General's Fifty-fifth Annual Report*, 1895.)

of the climate around the Metropolis, and prove that the much higher rate of London itself (21·42) is not attributable to naturally unhealthy climatic conditions.

Prevalence of Disease.—Passing now to the incidence of disease within the district, it may be noticed in the first place

how greatly the death-rate from the various zymotic diseases varies in the different Midland counties. For example as regards measles, Staffordshire and Cheshire were during this decennium unsatisfactory. As regards pertussis Warwickshire showed a high mortality, and Hereford a very low one, while concerning enteric fever, Nottinghamshire on the one hand exhibited a severe mortality, while Herefordshire on the other experienced a death-rate considerably below that of any other English county.

Diarrhœa again, as might be expected, proved more fatal in the comparatively urban counties of Staffordshire, Nottinghamshire and Warwickshire. Its maximum mortality was, however, reached in Leicestershire, which has long enjoyed notoriety in this respect.

Worthy of note too, and very extraordinary, are the local variations in the mortality from puerperal fever and other accidents of child-birth. As Dr. Tatham points out, if a line be drawn from the Humber to the Severn, those counties to the south-east will be found to have a death-rate below the average for England and Wales, until the minimum is reached in Rutlandshire and Huntingdonshire, while the remaining counties to the north-west of the line will all be found to exceed the average. From their geographical position, the majority of the Midland counties will fall into the former group, but Worcestershire, Herefordshire, Nottinghamshire, Derbyshire, Cheshire and Shropshire all have rates above the average, the two last indeed coming third and fifth on the list, while the highest death-rates of all were registered in North and South Wales respectively.

Phthisis Mortality.—Of greater interest from our present point of view will be the consideration of the varying mortality from phthisis in the several counties. The following figures (see Table XI. p. 135) from Dr. Tatham's Report, corrected for age and sex, show how great are the differences to be met with, the figures varying from the minimum mortality of 1,217 per million in Worcestershire to 2,112 in North Wales.

As will be seen from the Table, the phthisical mortality rate for the whole of England and Wales amounted to 1,724 per million, and it is interesting to note that of the Midland counties now especially considered, Cambridgeshire alone exceeded this figure. All the remaining members of the group experienced a death-rate

lower than the average, and in many of them the difference was very marked. The five following counties indeed, which possessed the lowest mortality from phthisis, viz. Rutlandshire, Buckinghamshire, Leicestershire, Herefordshire, and finally, with the lowest rate of all, Worcestershire, were all of them, it should be noticed, Midland counties.

TABLE XI.

Phthisis, 1881-90. MEAN ANNUAL DEATH-RATES FROM PHTHISIS IN REGISTRATION COUNTIES, CORRECTED FOR AGE AND SEX DISTRIBUTION OF THEIR SEVERAL POPULATIONS.¹

REGISTRATION COUNTIES.	ANNUAL DEATHS IN A STANDARD MILLION.	REGISTRATION COUNTIES.	ANNUAL DEATHS IN A STANDARD MILLION.
England and Wales.	1,724	Kent	1,528
North Wales	2,112	Lincolnshire	1,527
Northumberland	2,095	Wiltshire	1,519
South Wales	2,003	Gloucestershire	1,510
London	2,001	Hertfordshire	1,502
Lancashire	1,923	{ North Riding	1,502
Hampshire	1,845	Berkshire	1,494
West Riding	1,834	Essex	1,479
Suffolk	1,803	Northamptonshire	1,453
Cornwall	1,788	Mounmouthshire	1,451
Durham	1,744	Derbyshire	1,432
Cambridgeshire	1,736	Oxfordshire	1,430
Devonshire	1,718	Shropshire	1,425
Sussex	1,666	Dorsetshire	1,424
{ East Riding	1,656	Westmoreland	1,418
{ Cumberland	1,656	Somersetshire	1,411
Huntingtonshire	1,646	{ Middlesex	1,394
Nottinghamshire	1,623	{ Staffordshire	1,394
Warwickshire	1,619	Rutlandshire	1,362
Cheshire	1,599	Buckinghamshire	1,355
Surrey	1,560	Leicestershire	1,315
Norfolk	1,553	Herefordshire	1,304
Bedfordshire	1,549	Worcestershire	1,217

¹ (Abridged from the *Supplement to the Registrar-General's Fifty-fifth Annual Report, 1895.*)

Cancer Mortality.—Lastly, attention may be briefly drawn to the varying cancer mortality in the different counties. The following Table (p. 136) from the Registrar-General's returns, corrected for age and sex, shows that here again, just as in the case of phthisis, the differences are very considerable. If the figures be

examined, it will be found that, setting aside London, the high "cancer" mortality of which is probably largely due to the numerous imported cases of malignant disease treated within the walls of its numerous hospitals, the highest death-rate of any county is possessed by Huntingdonshire. Not far behind, however, follow Cambridgeshire and Warwickshire, while Northamptonshire again is slightly above the average. With these exceptions, all the remaining Midland counties exhibit a cancer death-rate lower than the mean figure for England and Wales.

TABLE XII.

Cancer, 1881-90. CORRECTED DEATH-RATES PER MILLION LIVING, AGED 35 AND UPWARDS. THE COUNTIES ARRANGED IN DESCENDING ORDER OF CORRECTED RATES.¹

REGISTRATION COUNTY.	Corrected Deaths.	REGISTRATION COUNTY.	Corrected Deaths.
England and Wales. . . .	1,844	Oxfordshire	1,779
(London)	2,250	Cheshire	1,779
Huntingdonshire	2,157	Norfolk	1,775
Cambridgeshire	2,072	Hertfordshire	1,772
Sussex	1,999	West Riding	1,765
Warwickshire	1,976	Suffolk	1,749
Cumberland	1,914	Westmoreland	1,746
North Wales	1,914	Leicestershire	1,736
Northumberland	1,897	Essex	1,732
Surrey	1,891	Somersetshire	1,732
North Riding	1,884	Herefordshire	1,726
Northamptonshire . . .	1,881	Lancashire	1,706
Middlesex	1,881	Durham	1,696
Devonshire	1,835	Staffordshire	1,663
East Riding	1,831	Rutlandshire	1,663
Gloucestershire	1,825	Worcestershire	1,653
Berkshire	1,818	South Wales	1,647
Kent	1,815	Cornwall	1,630
Nottinghamshire	1,808	Wiltshire	1,604
Lincolnshire	1,795	Derbyshire	1,597
Shropshire	1,792	Buckinghamshire . . .	1,578
Hampshire	1,788	Dorsetshire	1,578
Bedfordshire	1,785	Monmouthshire	1,574

¹ (Abridged from the *Supplement to the Registrar-General's Fifty-fifth Annual Report, 1895.*)

Résumé.—From the evidence of statistics then it would seem that the general health of the Midland counties is remarkably good, though certain counties as a whole, from their containing manu-

facturing centres, possess a death-rate slightly above the average. *Concerning phthisis, the death-rate from every Midland county, Cambridge alone excepted, is below the average, while Herefordshire and Worcestershire, of all the counties of England, show the minimum figures. With regard, however, to cancer, Huntingdonshire and Cambridgeshire enjoy an unenviable notoriety, while the diarrhœa mortality of Leicestershire, and especially of Leicester itself, has long been notorious.*

PART II.

SPECIAL DESCRIPTION OF CERTAIN HEALTH RESORTS SITUATED
WITHIN THE MIDLAND COUNTIES.

WE may pass now from the foregoing general considerations concerning the district to a more detailed description of those places within its area, which enjoy a reputation as health resorts. Of these the most important is Malvern, and it may therefore be first considered.

MALVERN.

Definition and Physical Character of District.—**Malvern** is the general name given to the group of towns and villages which lie upon the slopes of the Malvern Hills. These famous Hills rise, as is well known, abruptly from the plains of Hereford and Worcester, and forming a single chain, extend for nine miles in a direction due north and south. The highest point of the range is the Worcestershire Beacon, and from its height of 1,400 feet there is to be obtained not only one of the most extensive views in Great Britain, but also one of the most picturesque and varied. The panorama seen embraces the whole of the beautiful Severn and Wye valleys, together with the Cotswold, Mendip, and Welsh Hills, while dotted about in the plain below are seen also Worcester, Cheltenham, Tewkesbury, Gloucester, Hereford, and many other places of interest.

Situated on the eastern slope of the range, and at the foot of the Worcestershire Beacon, at an elevation of 520 feet, lies **Great Malvern**, the central and chief of the various units, to which the name of Malvern is applied. Not far from it, and indeed really now but a continuation of it, is placed **North Malvern**, while below this again, and therefore at a lesser elevation, is situated the rapidly growing suburb of Great Malvern, known as **Malvern Link**. To

the south also, separated from Great Malvern by the Wells Common, lies the village of **Malvern Wells**.

In spite of their various names, however, it should be noticed that all these separate divisions of Malvern are placed on the eastern slopes of the range, and thus enjoy a similar exposure. But in this respect the last to be mentioned, namely the little village of **West Malvern**, is different. The scattered houses of which it is composed are placed *over* the brow of the hill, as we ascend from North Malvern. As a result therefore they are completely protected from the east and north, and reap the advantages of a western exposure.

Of these various divisions of Malvern (the total population of which in 1901 amounted to 16,448) the most important is Great Malvern, and the following description, though referring primarily to the latter, may be taken as applying to the others also, the village of West Malvern from its western situation alone excepted.

Geology.—Geologically the hills on which Malvern stands are of igneous origin, mainly consisting of diorite, but the rocks practically range from diabase to nearly true granite. The detritus, on which the town is built, is therefore porous, and this fact, combined with the situation, renders natural drainage almost perfect. As a result even after heavy rains the water rapidly disappears from the roads, and great dryness becomes one of the chief characteristics of the neighbourhood. It should be added also that there are no sheets of water in the immediate vicinity of Malvern, the Severn being four miles distant, and the Avon and Teme each six. The relative humidity of the air therefore is decidedly low.

Exposure to Winds.—From its eastern exposure it might have been expected that Malvern would have suffered severely from winds coming from this direction. Such, however, is not the case, for as a fact east winds in Malvern are but comparatively little felt. The explanation of this curious anomaly probably lies in the fact that behind and immediately above the town the hills, as already mentioned, rise abruptly to a height of nearly 1,000 feet. Against this rocky background the east winds strike with considerable force. Afterwards, however, they rebound, and a "Resilient Current" is formed. This seems to act as a natural

buffer, and on meeting the wind again breaks its original force. In this way probably is to be explained the protection from the east, which in spite of its position the town undoubtedly enjoys.¹

The prevailing winds at Malvern, as indeed elsewhere, come from the south-west and west, and from them the town is to a large extent sheltered. The protection afforded by the hills, however, is by no means absolute, for the western winds not uncommonly sweep over the summits of the range, and descend the ravines on its eastern face, sometimes with considerable force. In and around the town, however, the vegetation, though but slender on the hills above, is luxuriant, and many beautiful trees offer substantial protection from the wind.

General Description of Climate and Meteorology.—The accompanying Tables, obtained from data accumulated during the years 1891–1897 (the only period available), demonstrate some of the chief points of interest in connection with the climate. It is unfortunate that these figures, since they refer to a different series of years, cannot be compared in detail with those from the other stations quoted in this Report.

MONTHLY MEANS FOR THE SEVEN YEARS 1891–1897.

Station, MALVERN, WORCESTERSHIRE. Height above Mean Sea-level, 520 feet.

A. MANDER, Esq., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.)	RAIN.	
	1 Highest.	2 Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.			Mean Cloud (9 a.m.)	Days it fell. Inches.
January	54.2	10.5	31.0	40.3	32.0	8.3	36.1	88.0	6.9	15.2 2.13
February	62.0	10.0	31.0	44.3	34.0	10.3	39.1	85.8	6.9	11.1 1.47
March	65.7	24.9	33.1	49.3	36.3	13.0	42.8	80.2	5.9	14.4 1.75
April	79.0	27.4	34.8	55.5	40.1	15.4	47.8	75.5	6.5	12.1 1.36
May	80.6	31.9	39.4	61.6	44.3	17.3	52.9	69.8	6.0	11.2 1.80
June	84.1	40.0	37.3	68.2	51.2	17.0	59.7	71.1	6.5	11.0 1.92
July	86.0	45.0	34.3	68.8	53.2	15.6	61.0	72.7	6.8	11.7 2.08
August	87.4	44.0	31.4	67.7	53.0	14.7	60.4	76.0	6.9	15.8 2.94
September	79.8	39.8	30.4	63.6	49.8	13.8	56.7	79.7	6.3	13.0 2.43
October	67.0	20.8	31.0	53.4	42.5	10.9	47.9	86.1	6.2	15.5 3.02
November	58.9	25.5	25.6	47.9	38.9	9.0	43.4	90.0	7.2	16.0 2.56
December	55.1	16.3	29.3	43.9	35.1	8.8	39.5	90.0	6.9	17.1 2.64

¹ For a somewhat similar condition of affairs see p. 288, where the protection afforded by a hilly background to the exposed northern shores of North Wales is discussed.

² Highest and Lowest = Absolute Highest and Lowest in Period.

MEANS FOR THE SEVEN YEARS 1891-1897—QUARTERLY AND YEARLY.
Station, MALVERN, WORCESTERSHIRE. Height above Mean Sea-level, 520 feet.

A. MANDER, Esq., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.							RAIN.		
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	Days it fell.
Jan.—March	65·7	10·0	31·7	44·6	34·1	10·5	39·3	84·7	6·6	40·7
April—June	84·1	27·4	37·2	61·7	45·2	16·5	53·5	72·1	6·3	34·3
July—Sept.	87·4	39·8	32·0	66·7	52·0	14·7	59·3	76·1	6·6	40·5
Oct.—Dec.	67·0	16·3	28·6	48·4	38·8	9·6	43·6	88·7	6·8	48·6
Whole Year	87·4	10·0	32·4	55·3	42·5	12·8	48·9	80·4	6·6	36·10

¹ Highest and Lowest = Absolute Highest and Lowest in Period.

The following Tables, however, in which such comparison is possible, demonstrate two important features in the climate, namely (1) the dryness of the atmosphere; (2) the equability of the climate.

RELATIVE HUMIDITY.

	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.
Scarborough . . .	85	85	84	87	88	85	83	83	83
Harrogate	85	84	83	81	82	78	81	—	—
Buxton	87	87	84	81	82	80	83	81	81
Kenilworth	83	84	83	81	84	80	84	—	—
Cheltenham	85	83	82	81	85	83	85	82	83
Marlborough . . .	—	85	—	82	86	83	86	—	83
Weston-super-Mare	84	85	87	87	85	83	86	85	85
Ilfracombe	90	87	83	83	84	86	85	82	81
MALVERN	81	82	80	77	82	79	81	82	81

MEAN DAILY RANGE OF TEMPERATURE.

	1892.	1893.	1894.	1895.	1896.	1897.	1898.
Buxton	15·4	16·0	13·9	15·6	14·5	14·2	14·6
Cheltenham	16·0	17·8	14·6	16·6	15·6	14·0	15·7
Chester	—	15·5	13·9	15·0	14·0	13·9	13·9
Lincoln	13·9	15·6	13·9	14·9	13·9	13·4	14·3
Marlborough	16·7	18·6	15·7	17·3	16·5	15·3	16·5
Tunbridge Wells . .	14·3	16·5	13·6	15·1	14·1	14·0	14·2
Mean	15·3	16·7	14·3	15·7	14·7	14·1	14·9
MALVERN	12·7	14·6	12·1	12·9	12·7	12·2	12·4

Concerning rainfall, it should be added that during the years 1881–1890 the average annual fall amounted to 29·17 in., an amount in harmony with the situation of the town in one of the Western Counties (cf. Table VII. p. 128).

It may be stated then that the chief characteristics of the climate of Malvern are as follows:—

The air is gently stimulating, the atmosphere remarkably dry, and the daily range of temperature but slight. The summers are comparatively cool, while the winters are not severe.

Such are the chief points to be borne in mind, but in addition it should be added that a great deal of bright sunshine is often experienced, while from its situation fog is not common. Often indeed, when the plain below is shrouded in mist, Great Malvern is bathed in brilliant sunshine. Malvern Link, however, from its lower situation is less fortunate in this respect.

Concerning the *Seasonal Variations in the Climate* it should be noticed that the summers, as already stated, are comparatively cool. Moreover any excess of temperature is at once mitigated by the delightful breezes, always to be obtained on one or other of the numerous well-kept and easy paths, which traverse the hills in all directions.

The winters on the other hand are not severe. This is proved by the temperature figures, and is shown also by the vegetation. Thus many exotics, which would perish even in the lower country around, flourish well in the open air throughout the winter at Malvern. To give one example. In the severe winter of 1861–1862 while araucarias and other tender exotics in the gardens near Worcester perished to a great extent, hardly any were destroyed in Malvern.

The spring and autumn months in Malvern are especially charming.

Drainage and Water Supply.—It is unnecessary to delay long on these two important matters, for as regards both of them Malvern has reached a high degree of excellence. The water, of remarkable purity, is collected from the rain which falls on the Malvern Hills. It is then conveyed into a reservoir near the “British Camp,” capable of holding 44,000,000 gallons, and is afterwards filtered and then brought direct to the town.

The drainage is also admirable, the sewage being carried away

and treated on a sewage farm of forty-seven acres, in the rural district of Upton-on-Severn.

The Prevalence of Disease at Malvern and the Influence of Climate on Disease.—For the following particulars, as well as for much other help in the preparation of this Report, the writer is indebted to Dr. Andrew Brockatt of Great Malvern.

Anæmia of a simple type is fairly common, especially among domestic servants, and those who, coming to Malvern, lead from their occupation an indoor life. These cases readily yield to ordinary treatment. In visitors, however, who are able to take free advantage of the dry stimulating air recovery is frequently rapid, without recourse to drugs.

Scrofula and Tuberculous Diseases.—These are not common among the resident population. It may be added too that among the pupils at the numerous schools situated in Malvern, are many who have been sent either on account of previous glandular troubles or owing to a family history of tuberculous affections. In the majority of these cases the effect of a prolonged residence is most gratifying.

Phthisis.—This disease develops only very rarely among the residents, and most of the cases recommended to come here do extremely well. Hæmoptysis is not a common feature.

Chronic bronchitis, and catarrhs of the nose, throat, and larynx are uncommon, and such cases sent to Malvern generally do well. Cases of enlarged tonsils and adenoids are uncommon among the residents, and children who come here suffering from such complaints often improve much.

Asthma is very uncommon, and the majority of imported cases generally improve greatly.

Pleurisy and pneumonia are not common.

Acute renal dropsy, contracted granular kidney, calculus and gravel, are all infrequent.

Acute rheumatism, osteo-arthritis, and neuralgia are not common among the residents. It should be noted also that many of the numerous invalids, who come to live at Malvern, are sent on account of rheumatism, and of this class many derive great benefit.

Diseases of the skin and all epidemic diseases are very rare

The most common cause of death is old age, and the conditions associated therewith.

Conclusion.—It may be of value now to sum up briefly the chief therapeutical indications of the climate. It may be stated that those suffering from diseases of the respiratory organs, such as phthisis, chronic bronchitis, and asthma, will generally derive great benefit from going to Malvern to reside. The same also may be said of those who suffer from rheumatism, and especially from osteo-arthritis. In the latter complaint indeed the disease not uncommonly becomes arrested. Cases of gout again often show a diminution in the number of acute attacks, as well as manifesting a general improvement in other ways.

In addition, however, to these definite diseases it should be added that the air, owing to its mildly stimulating properties, is very suitable for those convalescing from various debilitating diseases, and in whom the more bracing air of the East Coast might not be suitable. Admirable results too are obtained in the case of those suffering from nervous breakdown, following excessive work, or possibly post-influenzal in nature.

Weakly children lastly, especially those suffering from tubercular glands, or continually recurring catarrhs, in nearly all cases do remarkably well.

The beneficial results occurring in these different conditions are sufficiently explained by the dryness and equability of the climate, and the gently stimulating character of the air.

The Malvern Springs.

No reference has yet been made to the springs, for which Malvern was once famous; the reason lies in the fact that the waters themselves though of extreme purity (and on this account largely bottled and sold as Table-water), yet contain only traces of mineral ingredients, and cannot therefore be regarded as possessing any special medicinal properties.

It may be added, however, that the Droitwich Brine is now conveyed directly from Droitwich to Malvern, so that the well-known Brine-baths may be obtained here also if required. As at Droitwich the brine can be heated by steam, instead of by the

addition of hot water, so that the percentage of salt in solution need not be diminished.

CHELTENHAM.

In the previous volume of this work (Vol. I, p. 589) a description of the Cheltenham Waters, from the pen of Dr. Archibald E. Garrod, will be found. In the present article therefore no further reference will be made to them, but the climate of the town and its therapeutical indications will be alone discussed.

Cheltenham (population in 1901, 49,439) is situated at an elevation of 184 feet upon the Chelt, a little tributary of the Severn. It lies seven miles to the east of the latter river, and may be said to nestle directly under the shadow of the bold western face of the Cotswold Hills. The fine escarpment here presented by the Oolite, sweeps round, as is well known, in a wide amphitheatre from north-east to south-east, and as a result completely protects the town from all winds coming from the east, and to a less extent also from those having a northerly or southerly direction. To the west, however, the town is fully exposed. It may be stated at once that this complete protection from the east constitutes Cheltenham's special characteristic. The town lies within the area of the Lias, but the majority of the houses are built not upon the clay but upon a layer of sand, which in many places overlies the former to a considerable depth. Owing to this, combined with the fact that from the configuration of the ground natural drainage is good, the dampness inseparable from a clay soil is diminished to a considerable extent.

The buildings in the town are fine, and the houses present an air of substantial well-being and comfort. What, however, strikes and pleases the visitor most is the abundant vegetation. Thus the streets and roadways are planted for the most part with avenues of trees, chestnuts, limes and silver birches predominating, while the public and private gardens are particularly rich in flowering trees and shrubs. As a result in the early summer lilacs, laburnums and may-trees vie with each other in adorning the town, and rendering it one blaze of colour. During the hot summer months too they offer welcome and refreshing shade.

The water supply of the town is derived from the Cotswold Hills. It is of constant supply, first-class quality, and particularly palatable.

The drainage also is satisfactory.

Rainfall.—During the years 1881-1890 the annual rainfall amounted to 27·49 inches, and it is of interest to note that this was the smallest fall recorded in the county. The explanation doubtless is to be found in the fact that, before reaching Cheltenham, the rain-bearing winds, coming mostly from the south and south-west, deposit a large portion of their moisture as they cross the high plateau of the Forest of Dean, while the east winds are similarly affected by the Cotswold Hills.

Meteorology and Climate.—The following Tables show the chief points of interest concerning the meteorology of the neighbourhood during the years 1881-1890. From a study of the figures (cf. also the Tables on pp. 122-130) it will be seen that *the temperature and other records do not materially differ from those of other Midland stations*. Cheltenham in fact like its allies records temperatures somewhat higher in summer and lower in winter than stations on the sea-coast, while its daily range of temperature, as well as the mean amount of cloud, are both somewhat greater.

The town, however, has acquired a reputation for being so remarkably hot in summer that it may be of interest to study the figures a little more carefully from this point of view. If this be done, it will be seen, as Mr. Tyrer, F.R.Met.Soc. first pointed out, that the temperatures here recorded are by no means excessive. Let us take for example the Table of mean maximum temperatures during June, July and August, the three hottest months of the year, given on p. 123. From this it will be seen that the temperatures recorded at Cheltenham are distinctly below those registered at the two Herefordshire stations, Ross and Burghill, and also lower than those occurring in London, while they are not at all dissimilar to those recorded at certain other Midland stations, namely Apsley Guise, Hodsock and Marlborough.

A very similar tale also is told by the following figures representing the *mean* temperature of the air during the same three months. (See p. 149.)

From these facts then it is clear that the temperatures registered at Cheltenham are by no means excessive, and that the

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.

Station, CHELTENHAM, GLOUCESTERSHIRE. Height above Mean Sea-level, 184 feet.

R. TYLER, Esq., B.A., F.R.Met.Soc., Observer.

Month.	TEMPERATURE OF AIR IN MONTH.						Mean Relative Humidity (9 a.m.)	Snow.	WIND (9 A.M. & 9 P.M.)				RAIN.			
	Mean Monthly			Mean of Highest.					Mean of Lowest.			Mean Cloud (9 a.m.)			Days it fell.	Inches.
	1 Highest.	1 Lowest.	Mean Range.	Mean of Highest.	Mean of Lowest.	Daily Mean Range.			N.	E.	S.	W.				
January	56·3	-3·3	35·2	42·8	32·4	10·4	37·6	3·8	2·6	3·1	11·3	4·4	7·5	17·1	2·13	
February	57·8	7·0	34·2	44·5	32·9	11·6	38·7	4·1	5·0	3·9	10·0	5·8	7·5	14·9	2·11	
March.	65·0	11·2	39·5	47·5	33·1	14·4	40·3	5·2	5·5	3·3	8·5	10·1	6·9	14·0	1·95	
April	71·2	20·6	39·7	53·6	36·8	16·8	45·2	77·9	1·2	7·3	7·2	7·1	7·0	14·6	1·95	
May	78·5	26·0	42·6	61·1	42·5	18·6	51·8	75·7	4	4·3	3·7	10·0	9·0	6·5	14·0	2·12
June	84·0	31·5	41·7	66·9	48·1	18·8	57·4	77·0	0	5·4	1·8	7·7	11·5	6·6	12·9	2·82
July	86·8	35·8	41·2	69·2	51·2	18·0	60·3	76·7	0	1·5	6	11·3	14·1	6·8	17·9	2·82
August	87·8	34·8	43·0	68·4	49·7	18·7	59·0	77·9	0	2·3	9	7·8	15·2	6·6	14·0	2·04
September	79·4	26·2	39·4	63·7	46·9	16·8	55·3	85·1	0	5·6	3·3	9·3	10·3	6·8	14·6	2·27
October	74·5	21·2	36·8	54·4	39·8	14·6	47·1	88·3	5	5·4	2·6	5·1	9·2	7·1	18·7	2·68
November	61·3	20·2	33·4	49·1	37·7	11·4	43·4	89·1	9	3·2	2·3	10·1	8·2	7·3	19·5	3·02
December.	58·2	5·5	35·4	42·7	32·7	10·0	37·7	89·6	3·5	3·8	2·3	10·7	9·8	7·5	17·7	2·19

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MEANS FOR THE TEN YEARS 1881-1890.—QUARTERLY AND YEARLY.

Station, CHELTENHAM, GLOUCESTER. Height above Mean Sea-level, 184 feet.

R. TYLER, Esq., B.A., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR						Mean Temperature of air.	Humidity (9 a.m.).	Snow.	WIND (9 A.M. & 9 P.M.).				Mean (10 a.m.)	Days it fell.	Inches.	RAIN.
	1 Highest.	1 Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				N.	E.	S.	W.				
January—March . . .	65.0	3.3	36.3	44.9	32.8	12.1	38.9	87.0	13.4	13.4	10.3	29.8	20.3	7.3	46.0	6.19	
April—June . . .	84.0	20.6	41.3	60.5	42.5	18.0	51.5	76.9	1.6	17.0	12.3	24.9	27.6	6.7	41.5	6.39	
July—September . .	87.8	26.2	41.2	67.1	49.3	17.8	58.2	79.9	0	9.4	4.8	28.4	39.6	6.7	46.5	7.13	
October—December .	74.5	5.5	35.2	48.7	36.7	12.0	42.7	89.0	4.9	12.4	7.2	25.9	27.2	7.3	55.9	7.79	
Whole Year . . .	82.8	3.3	38.5	55.3	40.7	15.0	47.8	83.2	19.9	51.9	34.6	100.0	114.7	7.0	189.9	27.50	

1 Highest and Lowest = Absolute Highest and Lowest in Period.

AVERAGE MEAN TEMPERATURE OF THE AIR DURING JUNE, JULY AND AUGUST,
1881-1890, AT THE FOLLOWING STATIONS.

<i>Inland (Midland) Stations.</i>		<i>Sea-coast Stations.</i>	
Regent's Park	61.0	Portsmouth	61.2
Norwood	60.8	Ventnor	60.4
Strathfield Turgiss	60.4	Brighton	60.3
Ross	60.1	Teignmouth	60.2
Burghill	59.5	Ramsgate	60.1
Apsley Guise	59.2	Guernsey	59.9
Cheltenham	58.9	Margate	59.9
Hodsock	58.4	Weymouth	59.8
Kenilworth	58.5	Worthing	59.7
Marlborough	58.2	Southampton	59.7
Belper	57.9	Falmouth	59.1
Macclesfield	57.3	Scilly	59.0
Cheadle	56.7	Sidmouth	58.5
Buxton	55.4		

feeling of great heat experienced here during the summer must be due to some other cause.

Briefly then it may be said that the climate of Cheltenham, which in general is bright, sunny, and free from fog, and not given to very sudden changes, presents so far as temperature is concerned no special peculiarity. The locality possesses indeed the features common to all Midland districts in that it is hotter in summer and colder in winter than places situated on the sea-coast, but in these respects Cheltenham occupies an intermediate position among the Midland stations. As may be seen from the Tables, it is neither so hot in summer as some, nor so cold in winter as others.

In spite, however, of these facts, owing to its complete protection from the east, and the entire absence of all stimulating breezes, the climate does become in the summer extremely hot and relaxing.

Concerning the variations of the climate in different seasons it may be said that in the spring and early summer the climate is very pleasant. In the summer and autumn, however, it is hot and very relaxing, while in the winter it is cold and somewhat damp.

The special characteristic of the climate, however, to which attention may once again be drawn, is the complete protection which it enjoys from the biting east winds of spring.

Prevalence of Disease.—Concerning the incidence of disease among the residents the following statement may be made. It is based on the valuable Reports kindly furnished by Dr. G. B.

Ferguson and Mr. G. A. Cardew, M.R.C.S., L.S.A., to whom the writer is indebted also for much additional information.

Anæmia is very prevalent, as indeed is found to be the case throughout the whole of the Vale District. It occurs chiefly in girls and young women, between fifteen and twenty years of age, and is very amenable to treatment.

Phthisis and tubercular diseases in general are not common. Amongst the well-to-do classes indeed they were rare. Bronchitis is more frequent. In 1898, out of a total of 828 deaths for the whole Borough, 56 were attributable to this complaint. Of these, however, 15 occurred in patients between the ages of 65 and 75, while 14 were in those aged between 75 and 85. To a great extent therefore these figures may be discounted. It should be noticed also that a good many sufferers from this disease come to Cheltenham winter after winter, and in a large majority of cases they do well.

Pneumonia, for the most part of the broncho-pneumonic type, occurs in little outbreaks from time to time. Pleurisy and asthma are both rare.

Acute renal dropsy is most uncommon; so also is chronic albuminuria.

Calculus of the bladder, it should be noticed, is almost unknown. Patients moreover who suffer from this complaint, often find great relief after coming to reside here. Renal calculus and gravel are rather more common, but the majority of such cases are mild, and operation is rarely necessary.

Rheumatic fever and osteo-arthritis are infrequent, but *muscular rheumatism and neuralgia are at times prevalent*.

Eczema and all skin diseases are rare.

Concerning epidemic diseases it may be said that typhoid fever is very rare. Scarlet fever, however, and diphtheria are both not infrequent, though in each case the disease is usually of a mild type.

Malaria is seen in visitors from the Tropics, officers home on leave for example, but with such exceptions it is otherwise unknown.

The following Table from the Registrar-General's returns for 1881-1890, shows in detail the various causes of death during this period. The commonest cause of all doubtless is old age, and

the conditions associated therewith. Elderly people indeed here commonly attain to ripe old age, and die as a rule at last of apoplexy, heart-failure, or bronchitis:—

MEAN ANNUAL DEATH-RATE AT CHELTENHAM, 1881-1890.

Annual Death-rate per 1,000.	{ Persons . . . Males . . . Females . . .	{ In Standard Population 16·67 18·12 15·30 }
Mean Population, 1881-91.	{ Persons . . . Males . . . Females . . .	55,145 23,031 32,114
Deaths from All Causes, 1881-90.	{ Persons . . . Males . . . Females . . .	9,787 4,565 5,222

DEATH-RATE FROM INDIVIDUAL DISEASES

Small-pox	0·00	Phthisis	1·43
Measles	0·44	Other Tub. & Scrof. Dis. . .	0·27
Scarlet Fever	0·07		
Diphtheria	0·08	Diseases of { Nervous System	2·46
Whooping-cough	0·22	{ Circulatory „	1·76
		{ Respiratory „	3·12
Typhus	0·00	{ Digestive „	1·21
Enteric Fever	0·16	{ Urinary „	0·46
Simple Continued Fever . . .	0·02	{ Generative „	0·09
Diarrhoea and Dysentery . . .	0·44		
Cholera	0·01	Puerperal Fever	0·07
		Childbirth	0·05
Cancer	0·83	Violence	0·43
Tabes Mesenterica	0·21	OTHER CAUSES	3·92

Therapeutic Effect of the Climate.—The climate of Cheltenham then, such as it has been described, is admirably suited for more than one class of patient. First and foremost it is indicated in the case of those who have lived long in hot climates, for at Cheltenham, while the air is bright, sunny, free from fog, and not given to sudden changes, protection is afforded from the biting east winds of spring, against which the constitution of such patients are but ill adapted to struggle. Many Anglo-Indians and Colonials accordingly reside here.

For similar reasons too the climate is especially suited to the

aged, while many patients also who suffer from chronic bronchitis find a residence at Cheltenham during the winter months highly beneficial.

For the young the climate, owing to its relaxing qualities, is not so suitable. That it is not actually injurious, however, is proved by the health of the 2,500 scholars in the very numerous schools for which Cheltenham is now famous. Nevertheless for the majority of these a more bracing climate would doubtless be preferable.

Rheumatic subjects, lastly, owing to the dampness of the late autumn and winter months, are better away from Cheltenham and its neighbourhood.

CLIFTON—BRISTOL.

A detailed description of Clifton and Bristol and their climatology is not possible within the limits of this Report. The following facts, however, may be noted.

In the first place, with reference to **Clifton**, it may be stated that, owing to the elevated situation of the ground on which the town is built, the climate possesses a somewhat bracing quality—bracing, that is to say, so far as this term can ever be applied to the soft air of the **West of England**.

The city of **Bristol** itself, however, lies lower, much protected by the surrounding high ground, and consequently sheltered from the breezes which give to the air of Clifton its stimulating character. The city itself therefore especially in summer is somewhat hot and stuffy. Lately, however, it has been growing rapidly, and the hills on the side opposite to Clifton, the so-called Knowle district, are being built over. Here, as also in the new lower-middle-class districts of Horfield and Bishopstown, the air is decidedly fresh.

In Clifton then, the important residential quarter, the air is stimulating, the rainfall for the West-country not excessive (33·87 inches for the 45 years ending 1897), while humidity is greatly diminished by the configuration of the ground, which allows of admirable natural drainage. It can therefore be truly described as most healthy—an important matter when the number of its schools and scholars is considered. Compared with Cheltenham, its great West-country rival in educational matters, it may be

said that while both places possess healthy climates, that of the former is distinctly relaxing, while that of the latter (Clifton) is comparatively-speaking bracing.

It should be added that chest complaints and renal affections as a rule do well in Clifton, the spring being specially suitable for them, for, while in the lower parts of the town shelter from winds is easily obtained, the climate itself at this time of the year is stated to be here actually warmer than in many places on the south and south-west coasts.

MINCHINHAMPTON COMMON.

This charming resort, also in Gloucestershire, was until quite recently known only to a few. During the last few years, however, it has been rapidly advancing in popularity, and at the present moment constitutes one of the finest and most beautiful inland health resorts to be met with in the country. It is situated on one of the eastern spurs of the Cotswolds, and lies some three miles from Stroud on the Great Western Railway, or may be reached from Woodchester station on the Midland line, from which it is distant less than two miles.

The Common consists of a large tract, some 500 acres or more in extent, of open table-land situated 380 feet above the level of the sea. This is bounded on all sides by valleys of singular beauty, while the magnificent views from the Common itself extend on clear days as far as the Black Mountains in Glamorganshire, and north-west as far as the Malvern Hills. The panorama which thus unfolds itself, if once seen, will not soon be forgotten.

The Common is situated on the great Oolite formation. The soil over the rocks is thin and natural drainage is excellent. The surface is accordingly often quite dry even within an hour after heavy falls of rain.

There are no trees on the Common itself, consequently here no protection from wind.

The climate of this elevated plateau is charming, and, for the West-country, bracing. Here too even in the hottest days of summer a breeze is for the most part to be obtained. Enthusiasts even go so far as to describe the air on this favoured upland as being "like wine," but to the writer it seemed that the air here was very similar to that found at places like Church Stretton on

the Shropshire Hills, on the hills above Great Malvern, and again on the Downs above Clifton—that is to say that in each case it had a stimulating character, but lacked that crispness and life-giving power which only East Coast air, and perhaps that of the Yorkshire moors, possesses.

As evidence of the beneficial character of the climate Mr. Basil Church, L.S.A. of **Minchinhampton**, the little township on the edge of the Common, to whom the Committee is indebted for many particulars, reports that while scrofula and tuberculous diseases in general are uncommon among the residents, visitors from the valley suffering from these complaints soon show signs of improvement. Phthisis again is uncommon among the permanent residents. Three cases, however, which were removed from the neighbouring valley of Brinscombe to the outskirts of the Common, soon showed marked improvement. The commonest cause of death is old age.

The great amusement to be found at Minchinhampton is undoubtedly golfing. An 18-hole course has been laid out on the Common, and to those fond of the game a summer visit to Minchinhampton (for it is chiefly as yet a summer resort) may safely be recommended. To those too who do not intend to play, the views from the Common will be a never-ending source of delight, while the air will be undoubtedly beneficial. To this class of visitors, however, the place presents one drawback, namely that, should they wish to explore the surrounding country, the excursion must always start by a descent into one of the valleys, while the corresponding ascent must conclude the day.

It may now be asked, where should visitors stay? Two places, Minchinhampton and **Amberley**, are open to their choice, both situated on the edge of the Common, and both suitable for a prolonged stay.

Of these Amberley is the prettiest, overhanging as it does the charming Woodchester Valley, but the accommodation here is at present scanty, while the drainage is unsatisfactory. Minchinhampton, on the contrary, though not so beautifully situated, offers greater facilities. It has a population of about 4,000, and lodgings except during August and September may here be easily obtained.

In conclusion then it may be said that those in search of a place

wherein to spend their summer holiday, and who desire good air, golf, and charming scenery in the Western counties, will find all their requirements satisfied, should they pay a visit to the Common, which four centuries ago Dame Alice de Hampton presented to the poor.

Here too cases of phthisis would undoubtedly benefit by a stay during the summer months. In the winter, however, the lack of protection from the wind renders the locality less suitable for such patients.

NOTE.—THE COTSWOLD SANATORIUM.

Not far to the north of Minchinhampton, and in very similar air, a Sanatorium for the open-air treatment of consumption has recently been established. From its situation on the Cotswold Hills it has been appropriately named the "Cotswold Sanatorium." Lying equidistant about seven miles from Stroud, Cheltenham, and Gloucester, it may be reached from each of these stations. The building has been designed to contain 32 beds, and is under the care of Dr. S. Pruen and Mr. C. Braine-Hartnell, M.R.C.S., L.R.C.P. The Sanatorium stands on the oolitic limestone formation, at a height of 800 feet. It has a southerly aspect, and is protected from the north and east by the higher points of the Cotswold range, which rise behind it. Further protection is also afforded by the numerous trees, mostly fir and beech, with which the grounds, 67 acres in extent, are thickly studded. These diminish greatly the force of the prevailing south-west winds.

The treatment is carried out on the well-known Nordrach lines, and from the stimulating character of the air, tempered by due protection, good results may be expected.

The charges are five guineas weekly.

LEAMINGTON.

(For many of the following facts concerning Leamington and Warwick, the Committee is indebted to the Reports kindly furnished by Dr. Philip Hicks and Mr. F. Gardner, M.R.C.S., L.S.A. For a description of the thermal springs of the former town, and their therapeutical uses, reference should be made to the article by Dr. Archibald E. Garrod in the previous volume of this work, vol. i. p. 583.)

The important and pleasing town of **Leamington**, with its broad streets and shady trees, (population in 1901, 29,077,) is situated on the Leam, a tributary of the Avon, and lies two-and-a-half miles north-east of Warwick. From the latter it was originally separate and distinct, but of late years a rapid extension of its boundaries

has taken place, and a continuous line of houses now practically unites the two.

The town is situated on the New Red Sandstone formation, at an elevation of 195 feet above sea-level. It occupies the adjacent sides of two hills, and the slopes of the valley between them. The houses are well-built, and for the most part rest on a gravel foundation. Some few, however, are built on clay.

The drainage of Leamington is excellent, and the water supply ample and satisfactory, though the water itself is somewhat hard. Owing to the configuration of the ground, and the porous nature of the soil, natural drainage is extremely good. The roads consequently dry rapidly after rain, and mud is rare. Owing also to its favourable situation the town enjoys very considerable protection from winds. Doubtless in part the result of this vegetation in Leamington is profuse. The visitor indeed cannot but be struck by the fine avenues of trees which adorn the town, and which constitute one of its most prominent and characteristic features.

The country around is undulating, well-wooded, and of considerable beauty, and affords admirable facilities for hunting. It abounds moreover in places of interest. Thus, besides Warwick, both Kenilworth and Stratford-on-Avon are within easy reach, while close at hand also are the picturesque Edge Hills, recalling memories of the Civil War, and of interest to the Physician especially, since at the battle fought here on October 23, 1642, Harvey himself was present.

Meteorology and Rainfall.

The following meteorological data for the years 1889-1898 have been kindly placed at the disposal of the Committee by Mr. J. Barnitt of Leamington.

The figures, it will be seen, agree fairly well with the fuller data obtained from Kenilworth, only a few miles distant, though it should be noticed that the period of observation not being the same, the data are not strictly comparable. It would seem, however, from them that we are justified in stating that the meteorology of the neighbourhood presents no special peculiarity, but that, like other Midland districts, the temperatures registered

MEANS FOR THE TEN YEARS 1889-1898.

Station, LEAMINGTON, WARWICKSHIRE. Height above Mean Sea-level, 195 feet.

J. BARNITT, Esq., Observer.

	Mean Temperature of Air.	Mean Daily Range.	Mean Relative Humidity.	Rainfall, in inches.
January	38.1	9.3	86.5	1.51
February	38.7	11.4	82.6	1.26
March	42.0	15.6	81.2	1.31
April	46.5	18.4	76.0	1.40
May	51.0	19.3	74.9	1.87
June	57.0	19.4	75.4	1.69
July	58.9	18.2	73.9	1.78
August	58.6	17.0	76.7	2.49
September	56.3	17.2	78.2	1.51
October	47.8	13.0	81.2	2.46
November	43.9	10.7	84.9	1.80
December	39.7	9.8	85.1	1.75
Whole year	48.2	14.9	79.7	20.83

are somewhat higher in summer, and also lower in winter, than are recorded at stations on the sea-coast. It may be added also that fogs in Leamington are very unusual, being confined to a few days in November, while thunderstorms too but rarely occur.

MEANS FOR THE TEN YEARS 1881-1890.

Station, KENILWORTH, WARWICKSHIRE. Height above Mean Sea-level, 290 feet.

F. SLADE, Esq., F.R.Met.Soc., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.							RAIN.			
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Tempera- ture of Air in Month.	Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	Days it fell.	Inches.
January	55.0	3.7	32.8	41.8	31.7	10.1	36.8	90.4	8.0	16.4	2.22
February	57.3	19.5	29.6	43.4	33.1	10.3	38.2	87.7	7.8	13.1	1.84
March	67.0	16.4	38.5	46.9	33.0	13.9	40.0	78.9	7.0	13.2	1.91
April	69.0	23.6	36.9	52.4	36.7	15.7	44.6	75.5	7.5	14.0	1.74
May	77.5	28.0	40.9	59.0	42.3	17.6	51.0	74.1	7.0	13.4	2.16
June	80.5	35.7	39.9	65.8	47.8	18.0	56.9	75.6	6.8	12.1	2.01
July	87.9	39.6	38.0	68.5	51.4	17.1	59.9	75.4	7.2	15.8	2.71
August	85.3	37.1	38.8	67.2	49.9	17.3	58.6	77.8	7.0	14.1	2.47
September	77.6	29.5	37.9	62.9	47.2	15.7	55.0	85.1	7.2	13.5	2.33
October	74.1	22.3	34.8	53.8	40.2	13.6	47.0	87.5	7.0	16.6	2.67
November	60.1	19.6	32.4	47.7	37.2	10.5	42.5	90.9	7.3	18.8	2.89
December	57.0	7.7	32.2	41.5	32.1	9.4	36.7	89.4	7.8	16.1	2.01

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.

Station, KENILWORTH, WARWICKSHIRE. Height above Mean Sea-level, 290 feet.

F. SLADE, Esq., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.							Mean Relative Humidity (p.m.)	Mean Cloud (9 a.m.)	RAIN.	
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Tempera- ture of Air in Month.			Days it fell.	Inches.
Jan.—March . . .	60·7	3·7	33·6	44·0	32·6	11·4	38·3	57·3	7·6	42·7	5·97
April—June . . .	80·5	23·6	38·9	59·4	42·3	17·1	50·8	76·1	7·1	30·5	5·61
July—Sept. . . .	87·9	29·5	38·2	66·2	49·5	16·7	57·8	79·4	7·1	43·4	7·51
Oct.—Dec. . . .	74·1	7·7	33·1	47·7	36·5	11·2	42·1	89·3	7·4	51·5	7·57
Whole year . . .	87·9	3·7	35·9	54·3	40·2	15·1	47·3	83·0	7·3	177·1	26·96

1 Highest and Lowest = Absolute Highest and Lowest in Period.

The mean rainfall for the years 1881-1890 was only 24·51 inches. This low fall, combined with the porous nature of the soil, and the good natural drainage, succeeds in rendering the neighbourhood unusually dry.

Prevalence of Disease.—Concerning the incidence of disease in Leamington Dr. Philip Hicks reports as follows:—

Anæmia and debility are met with among domestic servants and others, who from their occupation cannot enjoy sufficient fresh air. Apart from these conditions, however, they are rare. Bronchitis and catarrhs are common. Phthisis, and tubercular diseases in general, lobar pneumonia, and asthma, are all infrequent. Pleurisy is sometimes met with. Acute rheumatism is rare, but muscular rheumatism on the contrary is somewhat common. Neuralgia is very frequent. Gout, gravel, and gouty manifestations in general, such as for instance gouty eczema, are from the number of elderly people who abound in Leamington all very common. Other skin affections are rare. Calculus of the bladder is practically unknown.

Concerning epidemic disease it may be stated that typhoid fever and diphtheria are most rare, but that small outbreaks of scarlet fever occasionally occur. Malaria is unknown.

Climate and its Therapeutical Indications.—Leamington may be said then to possess a mild, dry and healthy climate, and to enjoy in addition considerable protection from winds. The air,

however, at times is distinctly relaxing in character, a fact which is most noticeable in the months of August and September. The early summer is as a rule delightful, while the winters in general are mild.

Owing to the characteristics of its climate a residence in this pleasing town will in certain cases be found beneficial. It may be recommended, for example, in the case of those who are fragile, delicate, and neurotic, but above all for those who are advancing in years. It is especially indeed in the aged that the most marked benefits from a residence in Leamington are found to result. As a consequence large numbers of elderly people in easy circumstances, retired public servants and others, come here to reside.

WOBURN SANDS.

This little place cannot as yet claim to be regarded as a Health Resort, but its climate and surroundings are so suitable for the treatment of various pulmonary and other disorders that a short description of it must now be given.

Woburn Sands is situated upon the Greensand area of Bedfordshire, but close to the Buckinghamshire border of the county. Originally separate, it has now by a process of growth become united in one with the adjacent and older village of **Apsley Guise**. By road it is distant some forty miles from London, but by train it is further, and the journey from Euston occupies, including the change at Bletchley, generally an hour and a half.

The little town, which forty years ago consisted of only a few scattered houses, but now numbers 1,300 permanent residents, as well as some 200 annual visitors, nestles on the south-western slopes of thickly-pine-clad hills, at an elevation of between 400 and 500 feet above the level of the sea. Owing to its situation it is thus completely sheltered from all easterly winds, and to a considerable extent also from those blowing from the north. To the south and west, however, it is exposed.

The surrounding neighbourhood is hilly, and remarkably well wooded. Indeed the beautiful pine woods, to which free access may be obtained, and which afford delightfully shaded walks in

summer, extend for miles around. Some three miles distant stands Woburn Abbey, the seat of the Duke of Bedford. This, with its herds of deer, yaks, buffaloes and zebras, roaming at will through the spacious park, constitutes one of the chief attractions of the neighbourhood.

Geological Formation and Soil.—The village stands, as already mentioned, on the area of Greensand, which stretches across the county of Bedford from east to west. The surface soil accordingly is of a porous sandy nature, while the subsoil is, for the most part, gravel. As a result of this, and also owing to the hilly character of the ground, natural drainage becomes extremely good, and the neighbourhood in consequence remarkably dry.

Trees and Vegetation.—The surrounding hills are, it has been stated, all of them covered with trees. For the most part they consist of firs, but beech, oak, and elm are also to be seen. These trees afford considerable protection to the town. It should be added that in several of the gardens eucalyptus and other similar trees flourish out of doors throughout the year, thus evidencing the mildness of the climate.

Meteorology and Climate.—The following Tables show the result of the meteorological observations made by Mr. Dymond, F.R.Met.Soc., during the years 1881-1890.

MEANS FOR THE TEN YEARS 1881-1890.

Station, APSLEY GUISE, BEDFORDSHIRE. Height above Mean Sea-level, 433 feet.

E. E. DYMOND, ESQ., J.P., F.R.Met.Soc., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.)	SUNSHINE.		RAIN.		
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.			Total Hours.	of Possible Duration.	Mean Cloud (9 a.m.)	Days it fell.	Inches.
Jan. . .	55.8	6.9	33.0	41.4	32.0	9.4	36.7	93.2	46.1	18	7.0	15.6	1.69
Feb. . .	56.9	14.8	31.0	43.0	32.5	10.5	37.8	90.8	57.6	21	7.5	12.7	1.47
March . .	66.7	16.2	37.9	47.1	32.9	14.2	40.0	84.7	109.5	30	6.7	11.1	1.56
April . .	70.7	24.0	38.0	53.1	36.5	16.6	44.8	77.7	133.5	32	7.1	14.0	1.69
May . .	79.5	27.5	42.3	60.7	42.1	18.6	51.4	72.9	187.0	30	6.9	13.1	2.18
June . .	82.9	34.0	39.4	66.6	47.9	18.7	57.3	73.6	171.0	35	6.7	11.5	1.75
July . .	90.7	39.5	37.9	69.9	51.4	18.5	60.6	72.8	178.3	36	6.7	14.7	2.27
August .	88.0	38.5	40.8	68.6	50.5	18.1	59.6	74.3	176.9	40	6.6	12.5	1.84
Sept. . .	79.2	32.6	36.1	63.6	47.7	15.9	55.6	83.1	128.0	34	6.7	13.2	2.11
Oct. . .	75.2	23.8	33.7	54.0	40.9	13.1	47.5	85.9	98.7	30	6.5	16.1	2.40
Nov. . .	69.0	19.8	32.3	47.5	37.4	10.1	42.4	91.6	59.2	23	7.0	16.4	2.60
Dec. . .	57.8	2.3	32.2	41.0	31.7	9.3	36.3	92.8	40.1	17	7.2	15.4	1.88

¹ Highest and Lowest = Absolute Highest and Lowest in Period.

MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.

Station, APSLEY GUISE, BEDFORDSHIRE. Height above Mean Sea-level, 433 feet.

E. E. DYMOND, ESQ., J.P., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.)	SUNSHINE		RAIN.		
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.			Total Hours.	of Possible Duration.	Mean Cloud (9 a.m.)	Days it fell.	Inches.
Jan.—March . . .	66.7	6.9	34.0	43.8	32.5	11.3	38.2	89.6	213.2	23.0	7.1	39.4	4.72
April—June . . .	82.0	24.0	39.9	60.1	42.2	17.9	51.2	74.7	491.5	35.3	6.9	38.6	5.62
July—Sept. . . .	90.7	32.6	38.3	67.4	49.9	17.5	58.6	76.7	483.2	36.7	6.7	40.4	6.22
Oct.—Dec. . . .	75.8	2.3	32.7	47.5	36.6	10.9	42.1	90.1	198.0	23.3	6.9	47.9	6.88
Whole year . . .	90.7	2.3	36.2	54.8	46.3	14.4	47.5	84.8	1385.9	29.6	6.9	166.3	23.44

¹ Highest and Lowest — Absolute Highest and Lowest in Period.

From a study of the figures (cf. also pp. 122-130), it will be seen that the climate shows the characteristics of an inland station. Thus like Marlborough, Kenilworth, Cheltenham, and other Midland localities, it is hotter in summer and colder in winter than places situated on the sea-coast, while its mean amount of cloud is also somewhat greater. The low rainfall, however, (only 23.44 in.), as well as the small number of rainy days (166), should be particularly noticed. In short, the climate of Woburn Sands may be described as *dry* and *sunny*, mild and fairly equable, and in a word, extremely healthy.

Concerning the character of the climate in different seasons, the following statement may be made. The early spring, as is so often the case elsewhere, is usually somewhat rainy, the latter part of the season, however, is in general dry. In summer, though a great deal of bright sunshine is always experienced, the heat is never oppressive, being tempered always by cooling breezes. The autumns as a rule are very mild, while the winters are not severe.

Drainage and Water Supply.—The drainage and water supply, although they have never given cause for alarm, are not in accordance with the most recent sanitary requirements. These matters, however, are now under the consideration of the District Council, and it is probable that shortly all deficiencies in these respects will be made good.

Prevalence of Disease among the Residents.—The follow-

ing facts have been placed at the disposal of the Committee by Dr. J. Wright-Grant, to whom the writer is indebted in addition for much valuable information.

Anæmia and debility are not common, while the same may be said of scrofula and tuberculous diseases in general. Phthisis is rare, as also are bronchitis, pneumonia, pleurisy and asthma. Acute renal dropsy is very rare. Chronic albuminuria is common, and is probably in most cases associated with granular kidney. Calculus and gravel are infrequent.

Rheumatic fever among the residents is very rare indeed, while rheumatoid arthritis also is not common. Muscular rheumatism, however, is by no means an unknown ailment, but chiefly amongst the working classes. Neuralgia is uncommon.

Malarial affections are unknown. Typhoid fever is most rare. Diarrhoea, however, is fairly frequent, but chiefly during the hot weather. It is usually caused by the eating of unripe or over-ripe fruit, the country around being a large fruit-growing centre. Scarlet fever and diphtheria both occasionally occur. Diseases of the skin are very rare. The most frequent causes of death among the permanent residents are cerebral hæmorrhage, cardiac disease, and especially old age. Longevity indeed in this neighbourhood is very marked. At the present moment for instance three people aged 93, 95, and 96½ years respectively are living in Woburn Sands.

Therapeutic Effects of the Climate.—It has been stated that the climate of Woburn Sands is sunny, mild, fairly equable, and above all, dry. As such it would seem especially suited for patients suffering from chest complaints, and in fact cases of bronchitis and asthma after a short residence here are in almost all cases improved. Those too who suffer from heart disease, with its liability to attendant bronchitis, are also as a rule much benefited.

Cases of phthisis again very commonly improve, and if not cured, often remain quiescent.

Lastly, sufferers from rheumatism and rheumatic affections seem also to derive benefit from a permanent residence, further attacks of rheumatic fever for example being undoubtedly uncommon among those who have come here to reside.

While then Woburn Sands is a charming place in which the

healthy may well find rest and change, a prolonged visit, or even a permanent residence, is especially indicated in the case of those suffering from diseases of the respiratory system, or with one or other of the manifestations of rheumatism.

ASCOT.

A few words may now be devoted to **Ascot** and its neighbourhood, since this region has acquired some reputation as a health resort. The writer is indebted for many of the following facts to a careful and exhaustive Report kindly furnished by W. Netterville Barron, Esq., M.R.C.S., L.R.C.P.

Ascot is situated close to the south-western edge of Windsor Great Park, at a height of 309 feet above sea-level. The country around is undulating, and is chiefly characterized by the large pine woods, which extend for miles in many directions. These trees, though themselves a recent importation, are but the successors of the oak, beech and elm, which have flourished here from time immemorial, and which formed a portion of that Windsor Forest which once extended as far west as Hungerford.

Ascot itself, however, though admirably protected by the woods, is not in reality closely invested by them. This it owes chiefly to the fact that in its midst is situated the famous Heath, on which the historic Ascot races are run. This large and open space allows a free circulation of air, and prevents the scattered houses, of which Ascot in great part consists, from being in any way shut in.

Soil and Natural Drainage.—The soil, on which the houses stand, is composed for the most part of gravel, lying directly upon the Bagshot sands, which latter here attain a depth of 115 feet. Similar conditions also obtain in the country to the south, and partly so to the east and west. To the north the London clay comes to the surface.

Owing to the porous nature of the gravel and Bagshot sands, natural drainage on these formations is good. In Ascot accordingly, and especially in the neighbourhood of the Heath, where trees are few in number, and unable therefore of themselves to

produce dampness, the soil is undoubtedly dry. On the open Heath itself, even in winter, the dryness of the soil is remarkable.

The average annual rainfall in this region, it should be added, is approximately 26 inches.

It is matter for regret that no station of the Meteorological Society is situated in this neighbourhood, and that detailed and continuous meteorological data are therefore not available.

Water Supply and Drainage.—The water supply of Ascot is satisfactory, Thames water from Staines being now directly supplied.

As regards drainage, the larger residences possess private systems which act well and efficiently, but some of the smaller houses and cottage properties in the villages are too closely crowded together to permit of effective private effort, and some common system of drainage will doubtless soon be introduced.

Climate.—The climate of Ascot is bright, sunny, free from fog, and fairly equable. In the summer also it is undoubtedly dry, and even in winter, near the open Heath, the same may be said to be the case, though further afield, where the trees are more numerous, this quality is naturally less marked. The surrounding pine woods, for which the region is so famous, in summer render the air redolent with their perfume, and throughout the year afford admirable protection from the wind, except perhaps towards the north, where the country is more open.

For these reasons then Ascot must be regarded as eminently healthy, and it is not surprising also to find that cases of phthisis and bronchitis do well here, especially during the summer months, while cases of debility and anaemia as a rule are readily cured.

It should be pointed out, however, that, as already hinted, the country around Ascot is not always equally favourable from a climatological point of view, and that for this reason those who come to reside in the neighbourhood should exercise care in the selection of their house. Thus in certain places, nearer the river Thames, and lying at a lower elevation than Ascot, fogs are not uncommon, while again, in other directions, the fir trees are so numerous that in summer the atmosphere is rendered close and airless, and in winter somewhat cold and damp. As a result therefore in such localities, contrary to what occurs in Ascot itself, bronchial catarrhs and rheumatism are by no means uncommon. But from these disadvantages the region, which

stretches south and westwards from Ascot towards Wellington, is to a large extent exempt, and from its dry sandy soil this district has long enjoyed a deservedly healthy reputation.

Ascot then, and to a large extent its neighbourhood, must be regarded as remarkably healthy; and although perhaps from its numerous trees not suitable in general during the winter for rheumatic subjects, yet as a pleasant and healthy place of residence, within easy access of London, it may in many cases be warmly recommended.

THE PEAK DISTRICT OF DERBYSHIRE.

This district, which contains within its confines one of our chief inland health resorts and spas, and whose bracing air attracts annually an increasing number of visitors, deserves now a short description.

The "Peak district" is the name applied to the mountainous northern and north-western portion of the county of Derby. It is divided into two divisions, the "*High*" and "*Lower*" *Peak* districts. These differ in some important respects from each other; and notably in their geology, for while the former is composed chiefly of millstone grit, the latter is formed of mountain limestone.

The High Peak District.—This region, on the edge of which stands Buxton, forms a mountainous moorland area, stretching from the northern border of the county as far south as a line joining Chapel-en-le-Frith, Buxton, Castleton and Eyam, a distance roughly of from ten to fifteen miles. The elevations met with in this district range from 1,000 to 2,000 feet, the latter altitude being attained in Kinderscout, the highest point of the range. The climate of this region is remarkably bracing; the rainfall, however, as in all mountainous country, is heavy. Thus for the years 1881–1890 the average yearly fall at Buxton was 49·33 inches, and at Moorhead, in the very northern apex of the county, 52·03 inches. The configuration of the country, however, allows of such perfect drainage, that as a fact the roads dry rapidly even after the heaviest storms, and the district therefore should not really be considered damp.

Therapeutical Indications.—As a consequence of its bracing climate the whole of the High Peak region, especially now that it has been opened up by the railway, is admirably adapted for the purposes of a summer holiday. The centre to which the majority of visitors repair is naturally Buxton, but comfortable and less expensive lodgings may now be obtained without difficulty at many other places, for example the beautiful Edale Valley, and as a result increasing numbers come every year to enjoy the delightful scenery and splendid air.

Concerning **Buxton**, which lies on the edge of the district, it will be unnecessary to say more than a few words, it having been fully described in the previous volume of this work (Vol. I. p. 528). The following meteorological data, however, are of importance. (See pp. 167, 168.) From these it will be seen that the air, which in summer is delightfully keen and bracing, becomes in winter remarkably cold. Indeed if the data be contrasted with the returns from other localities (see pp. 122-130), it will be noted that the *actual mean minimum temperature of Buxton during the winter months is lower than that of any other English station*. The rainfall moreover is excessive (49·3 inches), though the inconvenience arising from this is greatly diminished by the admirable natural drainage, whereby dampness is prevented. The daily range of temperature is only 13·9, almost exactly similar to that of Norwood.

Owing to these climatic conditions, Buxton and its neighbourhood must chiefly remain places of summer resort, when the bracing character of its air may be safely recommended, though in some cases weakly and debilitated patients do well here even during the winter. For those, however, who suffer from chronic bronchitis the air in this season will be found too cold and irritating.

The Lower Peak District.—This area lying to the south of the High Peak region just described, is composed for the most part of mountain limestone, and stretches from Castleton in the north to Ashbourne in the south. It is hilly, and full of beautifully varied valley scenery. The hills do not reach the same height as those in the mountainous district of the High Peak, while the country differs also in being much more wooded, and consequently much less bleak. The climate is still bracing, though less so than that

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.

Station, BRUXTON, DERBYSHIRE. Height above Mean Sea-level, 987 feet.

E. J. SYKES, Esq., M.B., F.R.Met.Soc., Observer.

Month.	TEMPERATURE OF AIR IN MONTH.						SUNSHINE. ²		WIND.				Mean Cloud. (9 a.m.)	RAIS.				
	1 Highest.	1 Lowest.	Mean Monthly Range.		Mean of Highest. of Lowest.	Mean Daily Range.	Mean Temperature of Air in Month.	Mean Humidity (9 a.m.)	Hours.		Snow.	N.		E.	S.	W.	Days it Fell.	Inches.
									of Possible Duration.									
January	56.3	1.2	36.0	40.1	30.0	10.1	35.1	92.0	25.5	10.3	7.6	1.1	4.1	2.4	11.6	7.9	16.6	4.66
February	55.0	11.7	32.1	41.3	30.6	10.7	35.9	91.1	42.0	15.4	9.9	1.0	8.0	1.6	7.5	7.8	16.9	3.51
March	63.4	1.2	41.1	43.6	30.0	13.6	36.8	87.9	80.6	22.1	9.5	1.1	4.9	1.6	11.3	7.1	16.8	3.96
April	68.1	20.8	37.7	49.6	34.1	15.5	41.9	84.1	100.5	24.3	3.8	2.0	13.6	2.2	6.3	7.3	14.3	2.18
May	75.8	24.5	41.9	57.1	39.5	17.6	48.3	77.5	141.0	30.6	1.3	7	13.0	3.3	9.7	6.8	13.9	3.24
June	79.9	31.3	39.9	63.0	44.9	18.1	53.9	75.9	150.6	30.1	.1	.5	7.8	2.4	10.8	6.7	12.5	3.22
July	82.6	33.8	37.5	65.1	48.4	16.7	56.8	77.6	148.3	30.0	.1	.7	3.6	3.2	13.1	7.1	16.5	4.43
August	82.1	33.8	38.3	63.9	47.3	16.6	55.5	79.8	122.0	27.1	.0	.4	2.6	2.2	12.0	7.2	16.2	4.26
September	75.1	28.8	37.0	59.8	44.1	15.7	52.0	84.5	94.0	25.1	.0	.6	5.8	2.5	11.4	7.2	16.2	3.84
October	68.5	23.0	33.0	50.6	38.7	11.9	41.7	87.5	62.3	19.0	1.4	.8	7.2	1.4	11.2	7.4	18.9	5.23
November	58.1	18.1	31.1	45.1	34.8	10.6	40.2	90.9	33.5	13.0	3.6	.6	5.6	2.4	11.5	7.9	20.2	5.70
December	58.2	4.0	37.6	39.8	29.7	10.1	34.7	91.6	19.1	8.0	7.9	1.2	3.8	2.1	9.5	7.7	16.5	4.78

¹ Highest and Lowest. Absolute Highest and Lowest in Period.² The record is of *Sunlight*, not *Sunshine*, the apparatus used being of the Jordan pattern. These data are therefore not comparable with the other sunshine records in this paper, the latter all referring to *Sunshine*.

MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.

Station, BUXTON, DERBYSHIRE. Height above Mean Sea-level, 987 feet.

E. J. SYKES, Esq., M.B., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air.	Mean Relative Humidity (Fahrenheit).	SUNSHINE. ²		Snow.	WIND.				Mean (Gale).	Inches.	Days it Fell.	RAIN.
	1 Highest.	1 Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.			Hours.	of Possible Duration.		N.	E.	S.	W.				
Jan. March .	63.1	1.2	36.4	41.7	30.2	11.5	35.9	90.3	148.1	15.9	27.0	3.2	17.3	5.6	30.1	7.6	50.3	12.13	
April—June .	79.9	20.8	39.8	56.6	39.5	17.1	48.0	79.2	332.1	28.3	3.2	3.2	31.1	7.9	26.8	6.9	40.7	8.91	
July—Sept. .	82.6	28.8	37.6	62.9	46.6	16.3	54.8	80.6	361.3	27.4	1	1.7	12.9	7.9	36.5	7.2	48.9	12.53	
Oct.—Dec. .	68.5	4	31.0	45.3	31.1	10.9	39.9	90.0	114.9	13.3	12.9	2.6	16.6	5.9	32.2	7.7	55.6	15.71	
Whole year .	82.6	4	36.9	51.6	37.7	13.9	44.7	85.0	1019.4	21.7	42.2	10.5	30.3	27.3	155.9	7.3	196.5	49.51	

1 Highest and Lowest—Absolute Highest and Lowest in Period.

² The record is of *Shadlight*, not *Sunheat*, the apparatus used being of the Jordan pattern. These data are therefore not comparable with the other sunshine records in this paper, the latter all referring to *Sunheat*.

of the millstone grit area. The rainfall, however, is considerably less: that of Matlock Bath for example being only 35·2 in. as compared with 49·33 in. at Buxton during the similar period.

The following meteorological observations made at Belper, on the threshold of the district, demonstrate to some extent its climatological features:—

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.

Station, BELPER, DERBYSHIRE. Height above Mean Sea-level, 344 feet.

J. HUNTER, ESQ., JUN., F.R.Met.Soc., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.								RAIN.	
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature of Air in Month.	Mean Relative Humidity (a.m.).	Days it fell.	Inches.
						%				
January . .	56·1	6·5	31·9	41·5	31·8	9·7	36·7	90·4	15·9	2·70
February . .	57·9	22·2	28·0	42·9	33·3	9·6	38·1	89·9	13·8	2·27
March . . .	66·4	11·7	36·9	46·1	33·0	13·1	39·5	86·6	13·4	2·44
April . . .	69·3	24·4	37·2	51·7	37·1	14·6	44·4	81·1	14·2	2·04
May	77·0	29·5	39·4	59·1	42·7	16·4	50·9	78·7	13·6	2·42
June	80·1	34·3	37·0	64·7	48·2	16·5	56·5	79·0	11·4	2·24
July	84·0	39·0	35·2	67·2	51·5	15·7	59·3	79·9	15·6	2·73
August . . .	83·2	37·0	35·9	65·6	50·3	15·3	58·0	83·7	14·3	2·76
September .	74·6	31·0	34·5	61·2	47·4	13·8	54·3	87·4	14·6	2·53
October . . .	69·3	22·7	32·6	52·5	40·6	11·9	46·5	89·0	17·5	3·58
November . .	60·6	22·4	30·4	47·1	37·3	9·8	42·2	90·9	18·5	3·18
December . .	56·1	9·4	31·2	41·3	32·0	9·3	36·6	91·1	15·4	2·67

MEANS FOR THE TEN YEARS 1881-1890—YEARLY AND QUARTERLY.

Station, BELPER, DERBYSHIRE. Height above Mean Sea-level, 344 feet.

J. HUNTER, ESQ., JUN., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.							RAIN.		
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Tempera- ture of Air in Month.	Mean Relative Humidity (9 a.m.).	Days it fell.	Inches.
						%				
Jan.—March .	66·4	6·5	32·2	43·5	32·7	10·8	38·1	88·9	43·1	7·41
April—June .	80·1	24·4	37·9	58·5	42·7	15·8	50·6	79·6	39·2	6·70
July—Sept. .	84·0	31·0	35·2	64·7	49·7	15·0	57·2	83·7	44·5	8·02
Oct.—Dec. .	69·3	9·4	31·4	47·0	36·6	10·4	41·8	90·3	51·4	9·43
Whole year .	84·0	6·5	34·2	53·4	40·4	13·0	46·9	85·6	178·2	31·56

¹ Highest and Lowest = Absolute Highest and Lowest in Period.

Concerning the therapeutical effects of the climate it may be said that this district also may be recommended for a summer stay to those in search of stimulating air, though the quality of the air is not so keen, nor quite so invigorating, as that of the High Peak district.

It should be noticed, however, that though the above statement is true generally of the district, yet certain places within this area, such as Bakewell and Matlock, are from their situation in narrow valleys the reverse of bracing. Indeed they may be described as relaxing. Such exceptions are to be found in all mountainous regions, and only serve to emphasize the important part played by local conditions in modifying the climate in restricted areas.

THE MOUNTAINOUS REGION OF SOUTH SHROPSHIRE.

CHURCH STRETTON.

The county of Salop, as is well known, is divided into two nearly equal halves by the river Severn. The northern portion is flat, and is termed the "Shropshire Plain," while the southern, on the other hand, is hilly and even mountainous. It is to the latter to which attention is now directed, since in summer at least its beauty and stimulating air offer advantages which should be more fully known.

Geologically the region is of great interest, for the hills here are but the most eastern spurs of the ancient mountains of Radnorshire and Montgomery. Thus the Long Mynd (1,696 feet), which with its deep gullies and steep sides forms the most important mountain range in Shropshire, is Cambrian in origin. The Stiperstones (1,611 feet), with their extraordinary outcrops of quartzose rock, are Lower Silurian; while Wenlock Edge, with its bold limestone escarpment, belongs to the Upper Silurian formation. Igneous rocks too are not wanting, for *Caer Caradoc*, on which the British host encamped on the night previous to its disastrous fight with *Ostorius Scapula*, is an example of this formation. To the geologist therefore the region is one of unusual interest.

It is to be regretted that, with the exception of the rainfall, no

accurate meteorological data are to be obtained. The rainfall during the ten years 1881-1890 amounted at Much Wenlock to 31·03 inches.

The climate of the region is bright and sunny, and the air stimulating, and for the West Country even bracing. Even during the hottest months of the year breezes are to be obtained on the hills, and the heat is thus tempered. This healthy character of the air, combined with the pleasing scenery, are now obtaining recognition in the Midland counties, and yearly attract in the summer numerous visitors. So much is this the case that the village of **Church Stretton**, situated in the heart of this region, and to which visitors to the neighbourhood chiefly repair, is rapidly acquiring the status of a small inland health resort. The little village lies on and under the slopes of the steep Long Mynd, and forms an admirable centre for a prolonged stay. The views from the breezy hills around are very beautiful, while on the adjacent slopes of the Long Mynd itself a good golf course has recently been laid out. Every opportunity is thus afforded the visitor of fully benefiting from the delightful air. The newly-built hotel, it should be added, is comfortable, while suitable lodgings may without much difficulty be obtained.

To those then desiring to spend a summer holiday away from the sea-side in hilly country, at once beautiful, healthy, and interesting, Church Stretton and its neighbourhood may be recommended.

MEDICINAL SPRINGS OF THE MIDLAND COUNTIES.

Of the various medicinal springs situated in the Midland counties, those of Buxton, Droitwich, Cheltenham, Leamington and Ashby-de-la-Zouch are the most important. These, having been already considered in the previous volume of this work, will require no further description here. Of the other mineral springs which exist in the district, the majority possess but an antiquarian interest, and need not therefore detain us. A brief account may, however, be given of those which arise at Flitwick and Shearsby respectively.

The Flitwick Chalybeate Water.

The spring which produces this water, now somewhat extensively advertised, is situated in a valley close to Flitwick, and not far from Ampthill, both in the county of Bedford. The water is light yellow in colour, and possesses throughout the year a uniform temperature of 45° F. It is clear, and even after long standing shows no tendency to form a deposit. To the taste it is slightly acid.

On chemical examination it is found that iron occurs in the water in large quantities, and further that it exists in the *ferrie state*, as the *persulphate*. It may be at once pointed out that this condition is most unusual, since in the majority of chalybeate springs, for example Tunbridge Wells, Schwalbach, and St. Moritz, the iron is present as *ferrous carbonate*, held in solution by the presence of *free carbonic acid*.¹

An analysis of the water, made in the *Lancet* Laboratory,² revealed the following composition, the figures representing the number of grains present per gallon of the water:—

Persulphate of iron	170·80
Sulphate of alumina	28·00
Sulphate of soda	14·00
Sulphate of calcium	4·76
Silica	traces
Constituents of peaty matter	quantity undetermined (but considerable)

For purposes of comparison, or rather contrast, the analysis of the Tunbridge Wells water by Dr. J. Stevenson, published in the preceding volume of this work (Vol. I. p. 594), may here be reproduced. The great excess of iron present in the Flitwick water, as well as its different chemical combination, are at once apparent.

Ferrous carbonate	4·508
Calcium carbonate	0·184
Manganese carbonate	trace
Sulphate of magnesium	1·009
Sulphate of calcium	3·998
Chloride of potassium	0·501
Chloride of sodium	3·379
Chloride of ammonium	0·019
Chloride of magnesium	0·264
Silica	0·602
Organic matter	trace

¹ In the chalybeate spring at Trefriw in North Wales (see p. 327) the protosulphate is the iron salt met with.

² The *Lancet*, Oct. 24, 1891, p. 951. For further details concerning the spring, reference should be made to this article, from which many of the above-mentioned facts have been drawn.

Therapeutically the Flitwick water is said to be of value in cases of chlorosis, anæmia, and debility, and from its composition this may readily be believed. That it is of greater value than the pharmacopœial preparations of other persalts of iron, given in suitable doses, may be doubted. This at least has not as yet been proved.

The dose recommended for adults varies from a tablespoonful to a wine-glass taken twice a day.

The Shearsby Spring.

The little village of Shearsby, sometimes termed locally "Shearsby Spa," is situated nine miles south of Leicester. It can claim no title to distinction but such as may be drawn from the presence of its mineral spring.

The water of this spring is stated to have the following composition, the figures representing grains per imperial gallon :—

Chloride of sodium	245·53
Chloride of potassium	traces
Sulphate of soda	128·98
Carbonate of calcium	9·74
Carbonate of magnesium	6·24
Carbonate of soda	5·58
Carbonate of iron	trace
Hydrosulphide of sodium	0·27
Iodine and bromine combined	traces

It will be seen from these figures that sodium chloride and sodium sulphate are the main ingredients of the water, and further that the spring resembles certain of the Harrogate wells in that it possesses, though only in a slight degree, the odour and taste of sulphuretted hydrogen.

The water has been prescribed locally both internally and externally, and has been thought to be of some value in rheumatism, gout and eczema. Of late years, however, the "Spa" has been but little used. It is indeed somewhat inaccessible, while the bathing establishment connected with it is primitive.

APPENDIX

The following pages contain meteorological data, not inserted in the text, to which reference has been frequently made in the Report:—

I. SUNSHINE.¹

Average Sunshine at CAMBRIDGE and at OXFORD during the years 1881-90.

CAMBRIDGE. ²				OXFORD.			
MONTH.	Total Hours of Sunshine.	of Possible Duration.	Hours.	Total Hours of Sunshine.	of Possible Sunshine.	Hours.	
January	47.2	19.0	228.3 24.7	41.3	16	214.5 23.0	
February	63.0	23.0		61.6	22		
March	118.1	32.0	539.3 38.7	111.6	31	520.9 37.3	
April	147.8	36.0		141.2	34		
May	199.8	41.0	596.7 38.3	192.4	40	505.7 38.3	
June	191.7	39.0		187.3	38		
July	195.0	39.0	209.0 25.0	189.2	38	194.3 23.0	
August	176.6	40.0		182.6	41		
September	135.1	36.0	37.4 16	133.9	36	14.5 1.7	
October	105.6	33.0		101.5	31		
November	64.1	25.0	1457.4 30.4	55.4	22	1457.4 30.4	
December	39.3	17.0		37.4	16		
Whole year	1487.3	31.7					

Average Sunshine at WORKSOP (NOTTS.) and STREILEY-SOUTHWELL (NOTTS.) during the years 1881-90.

WORKSOP.				STREILEY.			
MONTH.	Total Hours of Sunshine.	of Possible Duration.	Hours.	Total Hours of Sunshine.	of Possible Sunshine.	Hours.	
January	35.4	14	189.6 20.7	31.1	12.6	183.5 19.9	
February	56.1	21		54.7	20.2		
March	98.1	27	453.9 32.3	97.7	27.0	455.2 32.7	
April	122.7	30		124.7	30.0		
May	174.6	36	418.8 31.3	178.3	37.0	412.4 31.3	
June	156.6	31		152.2	31.0		
July	159.9	32	165.0 20.0	154.6	31.0	157.4 18.7	
August	148.7	33		147.3	33.0		
September	110.2	29	27.6 12	110.5	30	27.6 12	
October	82.9	26		81.4	25		
November	50.2	20	1208.5 25.6	48.4	19	1208.5 25.6	
December	31.9	14		27.6	12		
Whole year	1227.3	26.1					

¹ The following Tables have been compiled from the figures recorded in *Ten Years' Sunshine in the British Isles*, published by the authority of the Meteorological Council, 1891. The figures express primarily *Sunheat*, the Campbell-Stokes instrument having been employed.

Average Sunshine at CIRENCESTER (WILTS.) during the years 1881-90.

CIRENCESTER.

MONTH.	Total Hours of Sunshine.	of Possible Sunshine.	Hours.	
January. . . .	44.5	18	222.7	24.3
February	68.0	25		
March	110.2	30		
April	142.2	35	526.5	38.0
May	196.9	41		
June	187.4	38		
July	183.3	37	483.3	36.3
August	179.7	40		
September	120.3	32		
October	97.6	30	189.9	22.7
November	53.7	21		
December	38.6	17		
Whole year	1444.4	30.3		

Average Sunshine at LEICESTER during the years 1881-90.

LEICESTER.

MONTH.	Total Hours of Sunshine.	of Possible Sunshine.	Hours.	
January. . . .	32.6	13.0	171.2	18.7
February	52.1	19.0		
March	86.5	24.0		
April	119.3	28.9	456.6	32.6
May	174.1	36.2		
June	163.2	32.6		
July	169.6	34.0	437.0	32.7
August	160.0	35.3		
September	107.4	28.7		
October	82.3	25.4	157.4	18.6
November	52.1	20.3		
December	23.0	10.1		
Whole year	1222.2	25.6		

Average Sunshine at BUNHILL Row and at KEW during the years 1881-90 (added for comparison).¹

BUNHILL Row.				KEW.				
MONTH.	Total Hours of Sunshine.	% of Possible Sunshine.	Hours.		Total Hours of Sunshine.	% of Possible Sunshine.	Hours.	
January.	11.3	4	94.1	9.7	36.1	14	190.6	20.3
February	24.0	9			49.9	18		
March	58.8	16			104.6	29		
April	107.2	26			138.1	34		
May.	168.9	35	439.4	31.3	200.1	42	525.4	38.0
June	163.3	33			187.2	38		
July.	162.5	33			190.2	39		
August.	151.9	34			181.5	41		
September	94.8	25	409.2	30.7	128.5	34	500.2	38.0
October.	60.5	19			95.9	29		
November.	20.1	8			51.7	20		
December.	3.9	2			35.3	15		
Whole year	1027.2	20.3			1399.1	29.4		

¹ See also for further details pp. 17 and 18 of this volume.

II.

THE following Tables, deduced from the observations made at the remaining stations of the Royal Meteorological Society, situated in the Midland counties, show the chief climatological features of the district. It should be added that the figures, together with the similar ones in the text, were worked out afresh for the purposes of this Report. Whenever possible, however, they have been controlled, and if necessary corrected, by those published by Mr. Campbell Bayard in the *Quarterly Journal of the Royal Meteorological Society for 1892*, since the writer understands that the latter were carefully and individually verified by the officials of the Society:—

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.
 Station, MARLBOROUGH, WILTS. Height above Mean Sea-level, 471 feet.
 REV. T. A. PRESTON, F.R.Met.Soc., Observer.

Month.	TEMPERATURE OF AIR IN MONTH.							Mean Humidity (9 a.m.)	SUNSHINE.		WIND.				Mean Cloud (9 a.m.)	RAIN.			
	1 Highest.	1 Lowest.	Mean	Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Range.		Hours.	% of Possible Duration.	Snow.	N.	E.	S.		W.	Days it Fell.	Inches.	
January	55.3	6.9	32.4	°	42.3	32.2	10.1	37.2	92.7	36.6	14.3	3.0	4	4.2	6.0	4.6	7.9	16.2	2.75
February	56.1	14.2	30.4	°	43.7	33.0	10.7	38.4	91.8	62.2	22.5	1.4	1.2	2.0	9.4	4.4	7.8	14.4	2.55
March	64.3	4.5	39.9	°	47.2	32.5	14.7	39.9	86.2	114.0	29.5	4.6	4.0	8.0	4.0	6.4	6.9	14.1	2.25
April	70.7	20.5	37.9	°	53.0	36.4	16.6	44.7	80.6	137.3	33.4	1.0	2.2	9.6	3.6	3.0	7.4	15.0	2.00
May	78.4	28.1	40.8	°	60.4	42.0	18.4	51.2	74.1	204.0	42.8	.8	2.6	6.6	1.8	6.8	6.9	13.3	2.10
June	84.1	29.9	42.2	°	66.1	47.4	18.7	56.7	76.7	162.8	33.1	.0	4.2	2.6	4.2	4.0	7.1	13.6	2.38
July	87.1	35.3	39.9	°	68.6	50.3	18.3	59.5	74.6	176.3	36.0	.0	3.4	2.0	5.0	6.0	6.9	17.8	2.97
August	87.6	32.0	42.2	°	68.0	49.1	18.9	58.5	75.6	180.3	41.0	.0	1.0	2.0	2.4	5.2	6.4	13.9	2.26
September	79.3	25.0	40.8	°	63.3	46.1	17.2	54.7	83.3	122.2	33.0	.0	2.4	2.4	3.2	2.8	7.0	13.9	2.42
October	71.7	18.0	36.4	°	54.4	39.3	15.1	46.8	88.2	96.3	30.0	.2	4.2	6.8	3.0	7.2	6.5	17.1	2.86
November	60.1	16.2	33.1	°	48.1	36.8	11.3	42.5	92.3	47.6	18.0	1.4	2.2	2.6	5.4	6.4	7.5	19.1	3.51
December	54.4	6.5	33.1	°	42.0	31.6	10.4	36.8	92.0	35.7	15.0	3.2	3.8	2.2	4.4	5.4	7.8	17.1	2.65

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.

Station, MARLBOROUGH, WILTS. Height above Mean Sea-level, 471 feet.

REV. T. A. PRESTON, F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.							Mean Temperature of Air in Month.	Mean Relative Humidity (° Fahr.).	SUNSHINE.		Snow.	WIND.				Mean (° Fath.).	RAIN.	
	Monthly Range.			Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Hours.			Of Possible Duration.	N.		E.	S.	W.				
	1 Highest.	1 Lowest.	Mean.																
Jan. — March .	64.3	4.5	34.2	44.4	32.6	11.8	38.5	90.2	212.8	22.1	9.0	5.6	11.2	19.4	15.4	11.7	7.55		
April — June .	84.1	20.5	40.3	59.8	41.9	17.9	50.7	77.1	501.1	36.4	1.8	9.0	18.8	9.6	13.8	7.1	41.9	6.48	
July — Sept. .	87.6	25.0	41.0	66.6	48.5	18.1	57.6	77.7	478.8	36.7	0	6.8	6.4	10.6	11.0	6.8	45.6	7.65	
Oct. — Dec. .	71.7	6.5	34.2	48.2	35.9	12.3	42.0	90.8	179.6	21.0	4.8	10.2	11.6	12.8	19.0	7.3	53.3	9.02	
Whole year .	84.6	4.5	37.4	54.8	39.7	15.1	47.7	84.0	1525.3	29.0	15.6	31.6	51.0	55.4	67.2	7.2	185.5	30.70	

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.
 Station, CHIDDLE, STAFFORDSHIRE. Height above Mean Sea-level, 646 feet.
 J. C. PHILIPS, Esq., J.P., F.R.Met.Soc., Observer.

Month.	TEMPERATURE OF AIR IN MONTH.						WIND.				RAIN.					
	1 Highest.	1 Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature of Air in Month.	Mean Humidity. (9 a.m.).	Snow.	WIND.			Mean Cloud (9 a.m.).	Days it Fell.	Inches.	
										N.	E.	W.				
January	56.1	9.9	30.3	40.9	31.9	9.0	36.4	91.9	6.7	4.6	8.2	7.0	8.4	7.5	17.6	2.46
February	56.9	20.2	27.0	42.3	32.5	9.8	37.4	90.9	6.9	4.2	10.5	6.4	6.2	7.4	15.6	2.03
March	65.9	18.2	35.1	45.1	32.7	12.1	39.0	85.6	7.8	5.9	11.2	5.5	8.4	6.7	16.1	2.37
April	67.7	25.3	33.4	51.0	36.3	14.7	43.6	80.7	2.4	6.6	14.3	5.0	3.8	7.0	14.7	1.95
May	74.3	30.2	37.6	58.1	41.9	16.2	50.0	77.6	.5	5.8	14.8	7.5	6.4	6.5	14.5	2.30
June	78.6	36.8	34.6	63.3	47.5	15.8	55.3	79.2	.1	9.0	10.9	5.9	7.6	6.5	12.4	2.73
July	82.8	37.5	33.1	65.5	50.4	15.1	58.0	81.9	0	8.5	4.3	9.4	9.6	6.9	17.8	2.89
August	83.1	37.8	34.6	64.4	49.5	14.9	56.9	82.6	0	6.6	6.4	5.7	12.4	7.1	15.5	3.04
September	77.8	33.2	31.5	60.6	47.1	13.5	53.9	87.0	0	6.0	10.0	6.3	7.9	6.6	15.3	2.77
October	68.2	26.4	30.2	51.8	40.5	11.3	46.2	88.9	.6	6.6	10.1	5.5	7.9	6.5	18.3	3.27
November	60.7	23.3	29.1	46.5	37.0	9.5	41.8	92.6	2.3	4.5	10.1	6.8	8.4	7.1	19.9	3.39
December	54.7	13.5	29.7	40.5	31.7	8.8	36.1	91.9	6.1	5.1	8.2	5.8	8.8	7.2	17.3	2.63

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.
 Station, CHEAULE, STAFFORDSHIRE. Height above Mean Sea-level, 646 feet.
 J. C. PHILIPS, ESQ., J.P., F.R.Met.Soc., Observer.

QUARTERS AND YEAR	TEMPERATURE OF AIR IN MONTH.						Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature of Air in Month.	Mean Humidity. (P. a.m.).	Snow.	Wind.				Mean Cloud (p.m.).	Days it fell.	Rains. Inches.
	1 Highest.	1 Lowest.	Mean Range.	N.	E.	S.								W.						
Jan.—March	65.9	9.9	50.8	42.8	32.4	10.4	37.6	89.4	21.4	14.7	29.9	18.9	23.0	7.2	19.3	6.86				
April—June	78.6	25.3	55.2	57.5	41.9	15.6	49.6	79.2	3.0	21.4	40.9	18.4	17.8	6.7	41.6	6.98				
July—Sept.	83.1	33.2	53.1	63.5	49.0	14.5	56.3	83.8	0	21.1	20.7	21.4	29.9	6.9	48.6	8.70				
Oct.—Dec.	68.2	13.5	29.7	46.3	36.4	9.9	41.2	91.1	9.0	16.2	28.8	18.1	25.1	6.9	55.5	9.29				
Whole year	83.1	9.9	47.2	52.5	39.9	12.6	46.2	85.9	5.4	14.4	119.4	16.8	95.8	6.9	195.0	31.83				

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.

Station, MACCLESFIELD, CHESHIRE. Height above Mean Sea-level, 501 feet.

J. DALE, Esq., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.							RAIN.		
	Actual Highest.	Actual Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	Days it fell. Inches.
January	56.0	3.3	30.3	41.6	32.2	9.4	36.9	92.7	6.5	17.2 2.81
February	56.7	14.8	28.5	42.5	33.0	9.5	37.8	90.5	6.5	15.4 1.94
March	66.0	14.4	36.0	45.1	32.9	12.2	39.0	88.1	6.7	15.5 2.59
April	69.2	23.5	35.7	51.1	36.8	14.3	44.0	82.0	6.8	12.4 1.79
May	77.1	28.6	39.3	58.7	42.4	16.3	50.5	75.1	6.3	14.6 2.39
June	81.2	32.7	37.6	64.3	47.6	16.7	56.0	76.5	6.2	13.4 2.92
July	84.0	40.2	34.9	65.8	50.9	14.9	58.3	80.0	6.6	18.3 3.67
August	83.9	35.7	36.6	64.8	50.2	14.6	57.5	82.9	6.8	16.5 3.49
September	75.5	31.4	33.8	61.0	47.3	13.7	54.1	87.0	5.9	15.8 2.99
October	70.5	23.1	32.7	52.2	40.4	11.8	46.3	89.8	6.6	18.4 3.41
November	60.6	20.7	30.0	47.0	37.4	9.6	42.2	90.6	7.0	18.1 3.50
December	55.7	13.5	30.6	41.1	32.0	9.1	36.6	90.1	7.1	16.3 3.10

MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.

Station, MACCLESFIELD, CHESHIRE. Height above Mean Sea-level, 501 feet.

J. DALE, Esq., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.							RAIN.		
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	Days it fell. Inches.
Jan.—March	66.0	3.3	31.6	43.1	32.7	10.4	37.9	90.4	6.6	48.1 7.34
April—June	81.2	23.5	37.5	58.0	42.3	15.7	50.2	77.9	6.4	40.4 7.10
July—Sept.	84.0	31.4	35.1	63.9	49.5	14.4	56.6	83.3	6.4	50.6 10.15
Oct.—Dec.	70.5	13.5	31.1	46.8	36.6	10.2	41.7	90.2	6.9	52.8 10.01
Whole year	84.0	3.3	33.8	52.9	40.3	12.6	46.6	85.4	6.6	191.9 34.69

¹ Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.

Station, HODSOCK, NOTTINGHAMSHIRE. Height above Mean Sea-level, 56 feet.

H. MELLISH, Esq., F.R.Met.Soc., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	50.4	1.6	35.4	42.7	31.6	11.1	37.1	89.6	7.2	16.6	2.00
February	54.9	16.8	32.5	44.5	33.1	11.4	38.9	87.9	7.4	15.1	1.56
March	68.4	5.3	42.0	47.7	32.9	14.8	40.2	82.3	6.6	13.4	1.91
April	71.4	20.7	41.2	52.8	36.2	16.6	44.5	76.8	7.3	15.0	1.70
May	79.7	26.2	44.8	60.5	41.5	18.8	51.1	71.9	6.6	14.2	2.38
June	83.6	32.3	44.9	66.0	47.3	18.7	56.7	72.5	6.9	11.9	1.76
July	86.0	37.7	39.6	69.0	50.9	18.1	59.9	72.1	7.0	15.7	2.36
August	87.0	35.4	40.2	67.6	49.4	18.2	58.6	75.3	6.9	13.5	2.28
September	78.2	28.7	39.4	63.3	46.6	16.7	54.9	82.6	6.9	11.7	1.78
October	71.1	22.9	37.0	54.5	40.6	13.9	47.5	84.6	6.7	17.2	2.66
November	64.5	14.7	35.1	48.4	36.9	11.5	42.7	88.9	7.0	17.5	2.05
December	57.7	7.7	35.5	42.3	31.7	10.6	37.0	90.0	6.9	16.2	1.85

MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.

Station, HODSOCK, NOTTINGHAMSHIRE. Height above Mean Sea-level, 56 feet.

H. MELLISH, Esq., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	68.4	1.6	36.6	45.0	32.5	12.5	38.7	86.6	7.1	45.1	5.47
April—June	83.6	20.7	42.6	59.8	41.7	18.1	50.8	73.7	6.9	41.1	5.84
July—Sept.	86.0	28.7	39.7	66.6	49.0	17.6	57.8	76.6	6.9	44.9	6.42
Oct.—Dec.	71.1	7.7	35.9	48.4	36.4	12.0	42.4	87.8	6.9	50.0	6.56
Whole year	82.0	1.6	38.7	54.9	39.9	17.0	51.4	81.2	7.0	182.0	24.29

¹ Highest and Lowest=Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.

Station, BURGHILL, HEREFORD-SHIRE. Height above Mean Sea-level, 275 feet.

J. A. CHAPMAN, Esq., M.D., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	59.7	1.1	34.4	43.7	32.5	11.20	38.1	91.7	7.6	16.4	2.06
February	58.9	19.3	39.8	45.4	33.6	11.81	39.6	89.1	7.4	12.9	1.96
March	65.6	14.7	38.5	48.9	34.0	14.87	41.3	82.8	6.9	13.1	1.67
April	72.4	23.9	39.0	54.6	37.4	17.25	46.1	78.5	7.2	13.0	1.86
May	79.6	27.9	42.0	62.3	43.1	19.13	52.7	74.2	6.7	13.6	2.16
June	86.4	34.9	39.6	67.9	48.4	19.56	58.2	73.3	6.7	11.9	2.21
July	88.5	39.2	39.3	70.4	51.2	19.20	60.7	73.7	6.9	15.9	2.47
August	88.2	35.3	41.0	69.4	50.0	19.39	59.7	75.9	6.5	12.7	2.04
September	78.2	27.3	38.7	64.4	47.0	17.43	55.7	83.9	6.8	12.8	1.82
October	74.6	20.1	39.1	55.3	40.5	14.74	47.9	88.3	7.1	16.7	2.34
November	62.0	18.3	34.5	49.4	38.1	11.41	43.8	90.9	7.2	17.6	2.87
December	57.7	6.1	33.4	43.4	32.5	10.85	37.9	91.6	7.2	16.9	1.92

MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.

Station, BURGHILL, HEREFORD-SHIRE. Height above Mean Sea-level, 275 feet.

J. A. CHAPMAN, Esq., M.D., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	Highest.	Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	65.6	1.1	34.6	46.0	33.4	12.6	39.7	87.9	7.3	42.4	5.69
April—June	80.4	23.9	40.2	61.6	43.0	18.6	52.3	75.4	6.9	38.5	6.23
July—Sept.	88.3	27.3	39.7	68.1	49.4	18.7	58.7	77.8	6.7	41.4	6.33
Oct.—Dec.	74.6	6.1	34.7	49.4	37.0	12.4	43.2	90.3	7.2	51.2	7.13
Whole year	88.5	1.1	37.3	56.3	40.7	15.6	48.5	82.8	7.0	173.5	25.38

¹ Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.

Station, ROSS, HEREFORDSHIRE. Height above Mean Sea-level, 213 feet.

H. SOUTHALL, ESQ., F.R.Met.Soc., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	1 Highest.	1 Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	56.6	2.9	33.7	43.6	33.1	10.5	38.4	90.0	7.0	17.1	2.81
February	59.8	18.7	31.5	45.5	33.8	11.7	39.6	87.4	6.8	14.5	2.24
March	66.0	15.8	38.8	49.2	34.2	15.0	41.7	81.1	6.1	14.0	2.06
April	71.8	24.6	38.5	55.1	37.8	17.3	46.5	77.0	6.8	15.4	2.15
May	79.8	28.4	41.9	62.7	43.3	19.4	53.0	74.2	6.2	16.0	2.36
June	88.0	34.2	41.9	68.6	48.8	19.8	58.7	73.6	6.0	14.1	2.37
July	90.5	38.1	39.8	70.8	52.0	18.8	61.4	74.2	6.3	18.0	2.99
August	86.6	37.4	41.6	69.9	50.7	19.2	60.3	75.7	5.9	15.2	2.28
September	79.9	28.0	38.8	61.6	47.6	17.0	56.1	82.9	6.3	16.2	2.30
October	73.3	21.8	35.3	55.2	41.0	14.2	48.1	84.6	6.4	18.6	2.32
November	69.8	19.8	33.6	49.6	38.8	10.7	44.2	88.5	6.7	19.1	3.27
December	58.0	10.5	33.0	43.3	33.2	10.1	38.2	89.4	6.8	15.9	2.23

MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.

Station, ROSS, HEREFORDSHIRE. Height above Mean Sea-level, 213 feet.

H. SOUTHALL, ESQ., F.R.Met.Soc., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR IN MONTH.						Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	1 Highest.	1 Lowest.	Mean Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	65.0	2.9	34.6	46.1	33.7	12.4	39.9	86.2	6.6	45.6	7.11
April—June	88.0	24.6	40.7	62.1	43.3	18.8	52.7	74.9	6.3	45.5	6.88
July—Sept.	90.5	28.0	40.1	68.4	50.1	18.3	59.3	77.6	6.2	49.4	7.57
Oct.—Dec.	73.0	10.5	34.0	49.3	37.7	11.6	43.5	87.8	6.6	58.6	8.92
Whole year	79.5	2.9	37.3	56.5	41.2	15.3	48.9	81.6	6.4	194.1	26.88

¹ Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TWENTY-FIVE YEARS 1871-1895.

¹ LOUGHBOROUGH, LEICESTERSHIRE.

MONTH.	Mean Maximum Temperature.	Mean Minimum Temperature.	Mean Temperature.	Rainfall in Inches.
January . . .	42·5	31·7	37·1	2·01
February . . .	45·2	33·0	39·1	1·71
March . . .	49·8	33·8	41·8	1·54
April . . .	53·7	37·7	46·7	1·71
May . . .	61·9	42·6	52·3	2·05
June . . .	68·6	48·8	58·7	2·20
July . . .	71·1	52·5	61·8	2·35
August . . .	70·3	52·0	61·2	2·50
September . . .	65·4	47·6	56·5	2·50
October . . .	55·6	40·9	48·3	2·83
November . . .	48·4	36·7	42·6	2·21
December . . .	43·0	32·3	37·7	2·24
Annual . . .	56·6	40·8	48·7	25·85

MONTHLY MEANS FOR THE TWENTY-FIVE YEARS 1871-1895.

¹ OXFORD.

MONTH.	Mean Maximum Temperature.	Mean Minimum Temperature.	Mean Temperature.	Rainfall in Inches.
January . . .	42·5	32·9	37·7	2·16
February . . .	44·9	34·2	39·6	1·76
March . . .	49·3	34·5	41·9	1·50
April . . .	55·2	38·8	47·0	1·66
May . . .	61·0	43·5	52·3	1·83
June . . .	67·1	49·9	58·5	2·11
July . . .	69·4	53·5	61·4	2·68
August . . .	69·1	53·0	61·1	2·32
September . . .	64·3	48·8	56·6	2·43
October . . .	55·4	42·0	48·7	2·75
November . . .	48·5	37·7	43·1	2·42
December . . .	43·2	33·6	38·4	2·10
Annual . . .	55·8	41·9	48·9	25·72

¹ The figures here given have been taken from *The Weekly Weather Report of the Meteorological Office for the year 1895*, Preface, page vi. Eyre and Spottiswoode, London, 1897.

MONTHLY MEANS FOR THE TWENTY-FIVE YEARS 1871-1895.

¹ CAMBRIDGE.

MONTH.	Mean Maximum Temperature.	Mean Minimum Temperature.	Mean Temperature.	Rainfall in Inches.
January . .	42·7	30·9	36·8	1·52
February . .	45·5	32·1	38·8	1·42
March . .	50·6	32·9	41·8	1·34
April . .	56·7	37·1	46·9	1·56
May . .	62·4	42·1	52·3	1·87
June . .	68·8	48·4	58·6	2·14
July . .	71·6	52·1	61·9	2·62
August . .	71·1	51·9	61·5	2·39
September .	66·0	47·9	57·0	2·13
October . .	56·4	40·9	48·7	2·41
November .	48·9	36·0	42·5	2·07
December .	43·2	31·6	37·4	1·82
Annual . .	57·0	40·3	48·7	23·29

¹ The figures here given have been taken from *The British Association Report of the Meteorological Office for the year 1895*, Preface, page vi. Eyre and Spottiswoode, London, 1897.

THE CLIMATE OF LANCASHIRE

By ROBERT MAGUIRE, M.D., F.R.C.P.

THE small detached portion of Lancashire, which lies north of the river Kent and of Morecambe Bay, and which really forms part of the "Lake District," will be treated of in the succeeding article. The present Report deals with the far larger area, perhaps nine-tenths of the whole, which constitutes the remainder of the county, and in which as a matter of fact are to be found the chief Lancashire health resorts. The latter are all situated upon the sea-coast, and may be enumerated as follows—Grange-on-Sands, Morecambe, Fleetwood, Blackpool, St. Anne's, Lytham and Southport, while with them will be mentioned two on the Cheshire coast, namely Hoylake and West Kirby. The order in which they are mentioned above is that of situation from north to south.

There are practically no inland health resorts in the district, further than such as might afford something like country air for those who live in the manufacturing towns which occupy most of the inland region. Such places as might be sought for this purpose are all in the northerly parts, and present no features which require attention in the Report. They are simply agricultural districts, flat, and without more to recommend them than the simple country life which must be led by any resident there.

To the Report is appended an account of the meteorological records from St. Michael-on-Wyre, Bolton, and Blackpool. The latter two records are the most important for the purposes of this Report, since they represent the inland and coast climates respectively. In this connection it should be noted how the temperature on the coast, as demonstrated by Blackpool, differs

from that of the inland country, as shown at Bolton. In the summer months the "mean of highest" is higher in the inland district, in the winter months somewhat higher on the coast. The "mean of lowest" is again higher on the coast, but in almost all portions of the year. The "mean daily range" is decidedly greater inland during the summer months. The "mean relative humidity" is greater at the sea-coast during the summer months, while in the winter months no important difference can be seen. "Mean cloud" is far less, as might be expected, on the coast, and in all parts of the year, and "rainy days" as well as the "rainfall in inches" show a similar peculiarity.¹

Referring now entirely to the coast resorts above-named, and reporting especially from personal observation, all look more or less to the west, but otherwise differ greatly in their general direction, and also in their climatic characters. Thus Grange has a south-west, Morecambe and Fleetwood have a north-west outlook, Blackpool and Southport face almost due west, St. Anne's and Lytham south-west, Hoylake west and north-west, and West Kirby south-west. Again, with a single exception, the climatic features are those of the sea-front. At West Kirby, as will be further described, a cliff of small height alters the conditions in a certain portion of the resort.

In nearly all the places named the easterly winds pass over a large tract of land before reaching the resort, and in the northern parts, as at Grange and Morecambe, are broken by a hilly hinterland, which however is at some distance. The sea-winds are all westerly, more or less.

Of all the resorts above-mentioned **Blackpool** is the most popular, and also possesses the most tonic atmosphere. The subsoil of the north of the town is boulder clay, resting on an "ancient plane of marine denudation," while that of the south is a bed of peat overlain by blown sand. The cliffs are of soft red sandstone. The sea-front is very extensive and bold, and for patients who are convalescent and require a strongly tonic air, Blackpool is eminently suitable at almost any time of the year. It would appear to be not so desirable for weakly patients in the winter, though even for them it is beneficial in summer or warm spring. It is not desirable for those who suffer from sub-acute or

¹ For further consideration of this subject, see pp. 122-129.

chronic bronchial troubles, or for tuberculous patients with active chest mischief, who have not been gradually acclimatized to a bracing air. Again, it is contra-indicated in cases of kidney trouble, in heart disease showing deficient muscular power of the ventricles with venous engorgement, and in such skin diseases as eczema, deficiency of cutaneous secretion, liability to erysipelas, etc., unless the mildest of summer weather be chosen for the sojourn. On the other hand, the air of Blackpool is in every way desirable for the treatment of tuberculous adenitis and post-nasal lymphatic adenoids, with their accompanying diathesis, always bearing in mind that an excessively weak circulation would counteract the beneficial influence of the tonic air. The sea-bathing is excellent.

Unfortunately the civic authorities of Blackpool have thought it best, in the interests of the town, to cater as much as possible—at least, in the summer months—for the requirements of huge crowds of “trippers” from Lancashire and Yorkshire, who render the place, during their stay, exceedingly undesirable for the invalid.

To the north of Blackpool the ground rises, and on this elevation a residential district is springing up, extending from Blackpool to Fleetwood, past the Rossall School, and here the air is even more tonic than in Blackpool itself, and naturally more quietude for the invalid can be obtained.

An attempt is being made to make Fleetwood a health resort, but nothing can be said in its favour. At low tide there is nothing to be seen but a huge extent of marshy sand, which about a hundred yards from the shore becomes mere quicksand. Even at high tide the place is depressing.

Morecambe and **Grange** suffer similarly from the extent to which the sea retires at low-water. Nevertheless, though in no respect bracing, they have their value, as alternative resorts, for those who require an equable climate, never very cold, and especially for patients suffering from chronic bronchial troubles, Bright's disease, and nerve-excitement. In consequence of their situation in the protection of Morecambe Bay, they are the more valuable in autumn and early spring than in the height of summer.

Southport, the next most important resort on the coast, cannot boast so bold a sea-front as Blackpool, and its air is never so bracing. Indeed, the sea retires so far at low tide as to be almost

invisible from the promenade, but leaves behind it an enormous stretch of sand, which, in the opinion of the writer, largely contributes to the health-giving properties of the climate. The authorities however have seen fit to alter this condition by making certain "inland lakes"—filled by the tide at high-water—out of the vacant sand space. This is by no means an improvement to the climate from the medical point of view. The air of Southport is very mild, dry, and also equable. Even in the height of summer it is not unduly hot, but it is pre-eminently a winter resort, and, in fact, has almost a model atmosphere for those suffering from chronic Bright's disease and bronchial affections. It is suitable, too, for cases of the later stages of pulmonary tuberculosis, and for such cases of cardiac disease as require absence from excitement. Again, during convalescence from acute lung affections and specific fevers, Southport may be recommended, but it is not sufficiently bracing for tuberculous adenitis, etc., or for neurasthenia and allied disorders. Southport and Blackpool—and indeed more or less all the resorts on the Lancashire coast—suffer from the lack of inland places of interest to relieve the monotony of the health resort itself. It must be remembered therefore that the patient sent to any of these places will be practically confined to the town.

St. Anne's and **Lytham** lie south of Blackpool, separated from Southport by the mouth of the river Ribble. Their climates are similar, and may be considered, like the locality of the resorts, as being midway between those of Blackpool and Southport, less bracing and also quieter than Blackpool, somewhat more exhilarating than Southport. They are essentially residential districts, but suitable especially for patients suffering from chronic lung and kidney troubles. St. Anne's is probably the more bracing of the two, because of its position.

The coast between Southport and the mouth of the Mersey need not be considered in any account of health resorts. It forms simply a series of the residential suburbs of Liverpool.

The two places on the Cheshire coast to be here mentioned are Hoylake and West Kirby. They lie on a promontory between the estuaries of the Mersey and the Dee, and although developed greatly in recent years, neither perhaps has received a deserved amount of attention.

Hoylake, especially, has been considered rather a place of amusement for golfers than a health resort, while the situation, and especially its broad expanse of fine sand, render it eminently suitable for many invalids. Its aspect is, roughly, west and north-west. Its sea-front, though not bold, is sufficiently pronounced to prevent its climate being relaxing, and even in winter the air is not unduly cold. It would be difficult to say what particular complaints would receive most benefit from the air of Hoylake; practically it would suit all patients for whom a more decided atmosphere was not desirable, but a word of warning may be given against allowing chronic bronchitics to stay here in the dull winter and early spring weather, when sea-mists are very prevalent.

West Kirby, near to Hoylake, has not the bold sea-outlook of the latter place. It faces almost south-west, and is practically on the northern shore of the river Dee, looking on to the Welsh mountains, and even Snowdon, on the opposite coast. Its climate is warm at all seasons of the year, and at any part of the town, though it must be remarked that a cliff specially protects the more easterly portion from east winds. The cases most likely to receive benefit from a stay at West Kirby are those of feeble circulation, with or without cardiac disease, and chronic pulmonary, bronchial and renal diseases. A sanatorium for the open-air treatment of pulmonary tuberculosis has recently been established here. The air is not bracing, and therefore not suitable for the majority of convalescents, but it is particularly mild in winter, and there is a large amount of sunlight. The soil is sandy, with a red sandstone subsoil. As at Southport and other resorts mentioned above, the stretch of foreshore at low tide is very great, and unfortunately at West Kirby is not covered by pure sand, but by a mixture of sand with a considerable amount of Dee mud. As at Southport, the authorities are trying to "improve" the outlook by making a "marine lake" near the promenade, and perhaps here there is more reason for the artificiality.

MONTHLY MEANS FOR THE FIVE YEARS 1881-1885.

Station, ST. MICHAEL-ON-WYRE, LANCASHIRE. Height above Mean Sea-level,
26 feet. The REV. P. J. HORNBY, Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	52.9	-7.5	42.72	32.72	10.00	37.72	88.2	7.82	17.4	3.38
February	57.7	23.12	45.86	35.82	10.04	40.84	88.4	7.78	18.2	3.19
March	66.2	20.0	47.98	34.06	13.32	40.72	82.6	7.28	16.2	2.92
April	69.7	25.2	52.66	37.10	16.56	45.38	75.4	6.82	12.0	2.00
May	78.0	28.2	59.60	41.28	18.32	50.44	70.2	6.22	13.4	2.12
June	81.6	35.6	63.88	46.86	17.02	55.37	73.2	7.46	13.2	2.82
July	80.5	38.6	66.54	51.14	15.40	58.84	78.8	8.04	18.8	4.30
August	84.9	35.2	65.52	50.06	15.46	57.79	79.0	7.94	16.2	3.76
September	79.0	30.0	62.46	46.88	15.58	54.67	81.8	7.12	16.8	3.88
October	66.3	23.7	53.70	41.22	12.48	47.46	84.6	7.20	17.2	3.87
November	61.2	21.3	48.62	36.82	11.80	42.72	89.2	7.16	19.8	4.14
December	52.7	16.6	43.65	33.62	10.03	38.63	90.6	7.50	18.6	3.41

MEANS FOR THE FIVE YEARS 1881-1885—QUARTERLY AND YEARLY.

Station, ST. MICHAEL-ON-WYRE, LANCASHIRE. Height above Mean Sea-level,
26 feet. The REV. P. J. HORNBY, Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.					Mean Temperature of Air.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	66.2	-7.5	45.3	34.2	11.1	39.8	86.4	7.6	51.8	9.40
April—June	81.6	25.2	59.0	41.7	17.3	50.4	72.9	6.8	38.6	6.94
July—Sept.	84.9	30.0	64.8	49.3	15.5	57.1	79.9	7.7	51.8	11.94
Oct.—Dec.	66.3	16.6	48.6	37.2	11.4	42.9	88.1	7.3	55.6	11.42
Whole year	84.9	-7.5	54.5	40.6	13.8	47.5	81.8	7.4	197.8	37.74

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.

Station, BLACKPOOL, LANCASHIRE. Height above Mean Sea-level, 31 and 62 feet.

REV. C. T. WARD, B.A. ; J. WOLSTENHOLME, Assoc. M.Inst. C.E., Observers.

MONTH.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	RAIN.	
	Highest.	Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	53.7	-0.5	42.47	33.38	9.09	37.92	90.4	7.40	18.40	2.96
February	55.1	20.1	43.27	34.48	8.79	38.87	91.0	6.72	16.20	2.09
March	63.9	18.6	45.04	34.53	10.51	39.78	86.5	6.38	15.22	2.74
April	67.9	24.2	50.92	37.64	13.28	44.28	80.1	5.94	14.40	1.79
May	78.9	28.7	57.44	43.22	14.22	50.33	76.2	5.67	14.20	2.47
June	83.0	35.8	62.49	48.74	13.75	55.61	75.4	5.52	11.80	1.96
July	82.5	42.3	64.27	52.83	11.44	58.55	78.0	6.05	17.30	3.62
August	82.9	36.2	63.72	52.04	11.68	57.88	78.3	6.40	15.70	3.21
September	75.5	31.1	60.95	48.66	12.29	54.80	82.5	6.22	16.20	3.34
October	68.0	25.6	53.43	43.07	10.37	48.25	84.8	6.92	17.10	3.37
November	58.6	22.7	48.11	39.10	9.01	43.60	88.0	7.21	19.80	3.97
December	57.0	15.3	42.07	34.04	8.03	38.35	90.3	7.46	17.80	2.74

MEANS FOR THE TEN YEARS 1881-1890.—QUARTERLY AND YEARLY.

Station, BLACKPOOL, LANCASHIRE. Height above Mean Sea-level, 31 and 62 feet.

REV. C. T. WARD, B.A. ; J. WOLSTENHOLME, Assoc. M.Inst. C.E., Observers.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.					Mean Temperature of Air.	Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	RAIN.	
	Highest.	Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	63.9	-0.5	43.6	34.1	9.4	38.8	89.3	6.8	49.8	7.79
April—June	83.0	24.2	56.9	43.2	13.7	50.1	77.7	5.7	40.4	6.22
July—Sept.	83.5	31.1	63.0	51.2	11.8	57.1	79.6	6.2	49.2	10.17
Oct.—Dec.	68.0	15.3	48.1	38.7	9.3	43.4	87.7	7.2	54.7	10.08
Whole year	82.5	-0.5	57.9	41.8	11.1	47.3	82.4	6.5	194.1	34.26

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE EIGHT YEARS 1882-1885 and 1887-1890.
 Station, BOLTON, LANCASHIRE (1880-1889). Height above Mean Sea-level, 390 feet.
 W. W. MIDDLEY, Esq., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	59.5	19.9	42.87	33.95	8.92	38.41	91.37	8.60	20.35	4.14
February	59.8	21.3	43.33	34.06	9.27	38.70	89.00	7.98	16.50	2.46
March	65.5	19.6	44.92	33.50	11.42	39.21	84.50	7.37	17.12	3.10
April	64.1	26.3	50.72	37.07	13.65	40.89	76.26	7.28	15.12	2.30
May	74.8	30.6	58.06	42.66	15.40	50.36	71.75	6.93	14.87	2.35
June	80.4	38.5	63.90	47.95	15.95	55.92	73.25	6.83	13.12	3.38
July	81.4	38.1	64.73	50.56	14.17	57.64	76.87	8.02	18.37	4.59
August	83.3	37.0	64.15	49.93	14.22	57.04	79.87	7.57	17.00	4.16
September	74.6	31.9	60.58	47.43	13.15	54.00	82.75	7.33	17.00	4.40
October	66.4	24.1	52.02	40.77	11.25	46.40	85.25	7.68	18.62	4.23
November	58.7	23.3	46.40	36.91	9.49	41.66	89.37	7.91	19.50	4.95
December	55.7	18.4	41.57	32.73	8.84	37.15	90.37	8.11	18.00	3.96

MEANS FOR THE EIGHT YEARS 1882-1885 and 1887-1890.—QUARTERLY AND YEARLY.

Station, BOLTON, LANCASHIRE. Height above Mean Sea-level, 390 feet.

W. W. MIDDLEY, Esq., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.					Mean Temperature of Air.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	65.5	19.6	43.7	33.8	9.9	38.8	88.3	8.0	53.8	9.70
April—June	80.4	26.3	57.5	42.5	15.0	50.0	73.7	7.0	43.1	8.03
July—Sept.	83.3	31.9	63.1	49.3	13.8	56.2	79.6	7.9	52.3	12.95
Oct.—Dec.	66.4	18.4	46.6	36.8	9.8	41.7	88.3	7.9	56.1	13.14
Whole year	83.3	18.4	52.7	40.9	12.1	46.7	82.5	7.6	205.3	43.82

1 Highest and Lowest = Absolute Highest and Lowest in Period.

THE CLIMATE OF THE LAKE DISTRICT

BY H. L. BROOKSBANK, B.A., M.B., B.C., CANTAB.

THE district known as the Lake District may for the purposes of this Report be defined as Cumberland and Westmorland, together with that portion of Lancashire, termed the Furness District, which is situated north of the Morecambe Sands. With this may be conveniently included the islands off the coast—the Isle of Man, the Calf of Man, Walney, Peel, and Foulney. Of the latter, however, only the first will receive any further consideration owing to the limited nature of this Report.

The two counties, Cumberland and Westmorland, together with the Furness district of Lancashire, have many claims to be embodied in one Report; for not only in their general physical and geological characters, but also in their historical interests are they united. Moreover, as will be seen, their inhabitants, the Dalesmen, who for hundreds of years past have lived their entire lives in this district, and who are now chiefly to be found in the more remote dales and valleys, have until quite recently formed a special and distinct type of population, differing in origin and in many other respects from the inhabitants of the adjoining counties.

The district considered (not including the islands) possesses an area of some 2,500 square miles, affording thus ample material to work upon. As however in this area no true health-resorts are to be found, and the majority of visitors are not invalids, but are attracted solely by the beauty of the scenery, it will be necessary only to point out the chief climatological and other features of the region: without going into those minuter details which would otherwise have been of importance.

Definition of the District.

This area, as a whole, constitutes the most north-westerly portion of England, and in part borders upon Scotland. Most of it lies to the west of the Pennine range; the range, which forms the dividing-line between the watersheds of the rivers, which flow into the Irish Sea and the German Ocean respectively. The northern limit of the district is formed by the Solway Firth, the rivers Sark and Liddel, together with the Kershope tributary of the latter, up to a point where the counties of Cumberland, Northumberland and Roxburgh join on the Bewcastle Fells. The eastern limit, abutting upon Northumberland, Durham, and Yorkshire, is formed in great part by the Pennine range; and, with two exceptions, practically keeps to the limit of the watershed which drains into the Irish Sea. The first exception is the Alston district of Cumberland. This area is on the eastern side of the range of hills, possesses an eastern aspect, and is in the South Tyne watershed. The latter river indeed rises within this district, and takes a north-easterly direction. The second exception is formed by the north-eastern corner of Westmorland. Here again a portion of the country, very thinly populated, lies to the eastern side of the range, and gives rise to the Tees.

The southern boundary extends as far south as the estuary of the river Kent, while the western limit borders on the Irish Sea, and forms the coast-line for about 125 miles.

The physical features of the district are divided between the lakes and upland tarns, bleak moorlands, mountains, and lowland mosses; these compensate in no small degree for the disadvantages of a westerly position.

Cumberland is nearly equally divided into arable, grazing, and waste land. In the former are some extensive woods; as for example at Netherby and Penrith. Only three towns, Carlisle, Whitehaven and Workington, contain a population of over 10,000.

Westmorland is almost entirely composed of agricultural grazings and waste land. Of the slates worked in this county those of Elterwater are of the highest commercial value. There

is only one town in this county, namely Kendal, which possesses a population of over 10,000 persons.

The Furness district of Lancashire is one of the great localities of the iron trade; consequently within this portion are situated three towns, Barrow, Dalton, and Ulverston, of over 10,000 inhabitants. Of these the rapid growth of Barrow has been phenomenal; comparable, it is said, only to the equally rapid rise of Middlesborough and Chicago.

Lakes and Rivers.

The Lakes form one of the great characteristic features of the district, and with them the various valleys and dales. On inspecting a map of the district, it will be noticed that the course of the streams and rivers, and consequently the direction of the valleys, can be roughly divided into two great groups—the one having a north-westerly direction, and the other a south-westerly or southerly course. These rivers and valleys are separated by the great central masses of mountains, which thus divide the district into two great watersheds.

If an imaginary line be drawn from Workington, on the coast of Cumberland, to the south-east boundary of the district, to that part where the river Eden rises on the Mallerstang Fells in Westmorland, it will divide this district into two great watersheds. In the northern portion are found the ten northern lakes, namely, Ennerdale, Buttermere, Crummock, Loweswater, Derwentwater, Bassenthwaite, and Thirlmere, all in Cumberland; Ullswater, partly in Cumberland and partly in Westmorland; and Haweswater and Brotherswater entirely in Westmorland. These, together with the valleys, give rise to the rivers and streams which take a north-west or westerly direction. They are characteristic mountain streams, and are named the Waver, Wampool, Line, Eden and its tributaries, the South Esk, Derwent, Ehen and Ellen. In the southern portion are found the six southern lakes: namely, Wastwater in Cumberland, Rydal, Grasmere, Windermere in Westmorland; and Esthwaite and Coniston in Lancashire. Besides these are innumerable smaller areas of water known locally as tarns, some of them being of considerable size. The six lakes give rise to the following rivers and streams, taking a

south-westerly or westerly direction—the Kent, Leven, Duddon, Esk, Crake, and Winster.

The Eden Valley.

Of the various valleys and rivers, the Eden differs most from the others, for it forms a complete contrast to the area strictly termed the Lake District. It is bounded truly by the Lake mountains on the west, and receives some of the largest tributaries from those mountains, and from the lakes of Ullswater and Haweswater; but the bottom of the valley is comparatively flat, and spreads out in the upper half to a width of some 10 miles, contracting however to half this size in mid-course; and widening out again towards Carlisle, after the Lake mountains have been passed. It is more highly cultivated than the generality of the district, though pasture still predominates largely over arable land. Large woods are almost absent, except about 10 miles above Carlisle. In past ages it held a more important position than at the present time. This is evidenced by the number of old feudal castles and manor-houses found in the area watered by the Eden, while the mountainous Lake District contains but few. As might be expected, those more ancient relics, runic crosses, are also more commonly found in the valley of the Eden, and along the coast-line of Cumberland than among the mountains. The inhabitants however are of the same race throughout the whole district, as is evidenced by their common dialect, (though there are curious differences between one town or valley and another only a few miles apart,) and by their family and place names, both of which proclaim a Norse descent.

Stirring times there must have been in the old days in this valley: for Carlisle and the great north road over Stainmore to York, and that through Lancaster to Preston, shared with the eastern marches by Berwick-on-Tweed the perils and glories of Border warfare. One would suppose too that the race of fighting men retained their vigour after the union with Scotland, for in the Civil War Carlisle was garrisoned, captured, and recaptured: and even the small population of Westmorland and Cumberland furnished towards the close 5,000 foot and 800 horse for the Royal Cause. Now the only relic of any combative qualities is the sport of wrestling, which is still kept up, and the extremely litigious

character of the people. In connection with sport it should be noted also that pole-leaping in this district is usual at all local athletic gatherings, and that the championship has been held by Westmorland men for many years. As regards wrestling, the Cumberland men stand first.

The Eden Valley is more sheltered from south-west winds than the adjoining valleys. Phthisis appears to be somewhat less prevalent in it than in the latter; while, on the contrary, morbus cordis and cancer are more frequently observed.

The Mountains and Hills over 1,000 feet above Sea-level.

These can be most briefly and conveniently divided into four groups:—

(1) The Northern or Skiddaw group—and (2) the Southern or Black Coombe group. These stand separate as wedge-shaped masses.

(3) The Western or Scawfell group, an irregular stellate mass of mountains with seven spurs; of these four have a north or north-westerly direction, the remaining three a south or south-westerly. Between these the principal lakes and valleys of the district are to be found.

(4) The Eastern or Helvellyn group.—This forms an irregular mass, with three spurs, all directed northwards, and between which are situated Ullswater and Haweswater Lakes.

In addition to the above four groups are the hills on the eastern boundary of the district: namely, the Pennine range.

Between the western and eastern group of mountains lies the great traffic road from the southern lakes to the northern, over Dunmail Raise. This route beginning at the Kent estuary passes through Kendal, Windermere, Ambleside, Grasmere, Keswick, and Cockermouth to Workington, Whitehaven, and Maryport on the coast. This road, taking the intervening places into account, forms the most thickly populated of the valleys of this district: and compared with it the old Roman Shap road to the north may be said to be almost deserted. The roads of this district are very good as a whole, the main roads especially so; but they are hilly, the gradients in many places being very steep.

Various minerals are, or have been, worked in Cumberland and Furness, but not in Westmorland. Coal is obtained on the coast of Cumberland about Whitehaven, Workington, and Maryport—also inland, though to a much less extent, as, for example, near Stapleton in North Cumberland. Hematite iron occurs in the Cleator district of Cumberland, dyeing the river Ehen a light red colour. Iron as hematite is also worked in the Eskdale valley and at Millom in Cumberland, likewise in the Furness district of Lancashire: lead (galena) is mined at Greenside near Ullswater, also near Threlkeld in the Saddleback district, both places being situated in Cumberland. Copper was formerly mined at Coniston in the Furness district of Lancashire. Lastly, plumbago, once possessing a medicinal reputation, was formerly worked at Borrowdale in Cumberland.

The Coast-line.—A marked contrast to the inland country is formed by the flat nature of the coast-line. At one place only along the latter does the rock, in the form of high cliffs, show itself at low-water mark, namely, at St. Bees Head. At several other places, as at Bardsea and Grange, it approaches the coast, but attains no height. The foreshore in most places consists of loose sand-hills of blown drift-sand, with or without an area of shingle of variable breadth between the sand-hills and high-water mark. The tide runs out for great distances, in some cases for several miles, on the Morecambe and Duddon sands, and also in the Solway, thus leaving great expanses of sand uncovered between high- and low-water mark. These are more or less treacherous to travel over, and were formerly more traversed than at present. It may be here mentioned that in certain localities along the coast are to be found extensive tracts of land, properly called “salt marshes,” but locally known as “mosses.” These are situated for the most part where two or more rivers converge to reach the sea: as for example where the rivers Waver, Wampool, Esk, and Eden, join the Solway estuary: or again in the Duddon and Kent estuaries, where similar conditions occur. These “mosses” are raised but little above sea-level, and consequently are in places liable to be covered by spring-tides. Their soil near the sea is sandy, but further off is of a peaty nature. But for rushes, heather, and scrub, they are barren of vegetation.

In many places however, and notably Seascale, the sands are suitable for bathing, and especially for children. For adults, the fact

that bathers have to go out long distances before any depth of water is reached is a disadvantage.

Along the coast certain places are situated which deserve mention. These are **Silloth**, where a convalescent home is established, **St. Bees**, **Seascale**, **Grange**, and **Arnside**, to which large numbers of holiday-makers annually resort. With the exception however of Grange, none of them can be said to possess even locally much reputation as health resorts.

The Inhabitants.—The inhabitants of this district form, as already stated, a special type of population. A brief description of them may not therefore here be out of place. Until quite recently the whole district now under consideration was peopled by this race; but at the present day, owing to increased facilities of travel, the true Dalesmen are chiefly to be found in the less populated districts and in the out-of-the-way dales and valleys. The typical Dalesmen are descendants of the old Norwegian Vikings.¹ They are tall, fully six feet in height. A writer indeed has stated that “the inhabitants of Strath-Clyde, including Cumberland and Westmorland, are the tallest men in the world”: whether this be literally true or not, it is certainly a fact that during the Napoleonic wars, when the men, recruited from the yeoman class of this district, joined the *dépôt*, no uniforms were found large enough to fit them. Their hair is fair, thin, and smooth, their bodies spare, apparently with no palpable subcutaneous adipose tissue, their bones and joints are large, their hands and feet apparently of remarkable size, and their phalanges long with long narrow nails. Their features are thin and angular, their countenance penetrating and open, and their appearance unusually solemn. Their gait is of a striding and yet shambling character, possibly in part at least due to continual walking over rough country in heavy boots. In character they somewhat resemble the border lowland Scotch, independent and self-reliant, very reserved, persevering, cautious in accepting evidence, usually saying less than they mean, by which they contrast with the Irish, while their general reticence and absence of display and gesture contrast them with the more open-hearted Yorkshiremen. They are not reckless or daring, but self-controlled and self-contained; sharp in seizing an opportunity of advantage, and resenting any

¹ *Northmen in Cumberland and Westmorland*. R. Ferguson, 1856.

kind of interference from strangers, whom they do not welcome with open arms. They are loyal to their friends, yet good hands at driving a bargain: humorous, clever of expression, and with the power of epigram; yet showing an almost total lack of artistic feeling. They are very economical, and usually keep something in reserve in case of necessity. In short they might with truth be termed a hard and healthy race.

Many of the local names and dialect words show from whence these Dalesmen are descended. They are not to be found out of this district, but possibly their nearest allies are the Dalesmen of Pembrokeshire.

Geology.—Examination of a geological map of this district shows a considerable development of lower Palaeozoic rocks, forming the irregular dome of Lakeland, and surrounded on nearly every side by a girdle of carboniferous limestone.

Above the latter to the north and north-east a large tract of country is occupied by Permian rocks, and to a slight extent by those of more recent formation. A narrow strip of the former stratum occurs also on the sea-coast, extending from Millom to St. Bees, while north of this is situated the Whitehaven coal-field. Limited areas of granite in addition are to be found. Of these the Eskdale granite, in the neighbourhood of Wastwater, may from its size be especially noted. The older rocks have been subjected to intense pressure resulting in repeated folding of their strata—the main axis of elevation passing through the Skiddaw range of Fells—and cleavage has also been superinduced to such an extent that slates have been quarried from almost all the formations, including even some of the beds of the Coniston limestone series. Most of the rocks furnish excellent building-stone. Outside the rich hematite deposits of Furness and West Cumberland there is but little metallic mining to be noted at the present time; it being practically confined to the Greenside lead-mine on the east side of Helvellyn and three or four lead-mines in the Saddleback district; but at various periods from rather early times there have been extensive workings both of lead and copper, some of the localities of which will be noticed later.

The frequent folding and faulting of the strata referred to above, causes repetition of the beds and makes a computation of the thickness of the rocks of the various divisions a matter of

difficulty; but approximate estimates have been attempted, and are given in the table below, in which the rocks of the area are classified :—

	Local Names, with their Welsh and Border Equivalents.	Maximum Thickness. Feet.
PALÆOZOIC.	Ordovician . . . { Skiddaw Slates = Tremadoc; Arenig and possibly Lower Rocks.	10,000 to 12,000
	Volcanic Series = Llandeilo (Lower Bala)	7,000 to 8,000
	Coniston Limestone = Middle and Upper Bala	400 to 450
	Stockdale Shales = Upper and Lower Llandovery	500
	Silurian { Coniston Flags and Grits } = Wenlock and Bannisdale and Kirby } Ludlow	12,000
	Moor Flags.	
	Carboniferous. { Basement Conglomerate	5,000 to 6,000
	Scar Limestone and Shales	
	Upper Limestone	
	Millstone Grit	
MESOZOIC.	Coal Measures	7,000 to 8,000
	Permian { Penrith Sandstones and Breccias	
	Clays with Gypsum	
NEOZOIC.	Upper Permian Sandstone	
	Triassic . . { Red Sandstone.	
NEOZOIC.	Liassic . . { Marls.	
	Pleistocene . { Boulder Clay, Moraines, etc.	
NEOZOIC.	Recent . { Peat Mosses, etc.	

Meteorology.—Special tables have been drawn up for this Report (see pp. 225–229), giving the mean monthly ranges of temperature, the humidity of the air, the mean cloud, and the rainfall. These data are forthcoming from five localities, but all unfortunately apply to Cumberland.

The five stations are (dividing the county into its Parliamentary divisions) situated as follows :—

I. ALSTON, east of the Pennine range, on the extreme east of the Mid-Cumberland or Penrith division.

II. NEWTON-REIGNY, near Penrith, in the same division as Alston, close to the Westmorland boundary, and practically almost in the centre of the whole district covered by this Report.

III. SCALEBY, in the north or Eskdale division.

IV. SEATHWAITE, in the south-west of the county, in the west or Egremont division.

V. STAPLETON, on the river Line, in the north or Eskdale division. This station is considerably further north than Scaleby.

The years, for which these monthly means are given, are stated on the tables, but do not correspond in all five cases.

General tables of the rainfall for Westmorland and the Furness district of Lancashire are also given (pp. 207 and 209), taking three localities in each county, but with the exception of a meteorological table given under Kendal no further data for these districts are forthcoming.

A table of rainfall for the Isle of Man and Calf of Man is given under a report from the former, together with a record of the sunshine observed at Douglas during the years 1881-1890 (see p. 223).

Climate.—The extreme variations in the character of the country, and the consequent local variations seen in the meteorological returns, render a general description of the climate difficult. The climate however of this region may be called mild, the purity of the mountain and moorland air compensating for any relaxing tendency which it may possess.

In the majority of the valleys there is great protection from east and north winds, especially from the former, owing to the shelter afforded to the whole region, with the exception of the Alston district, by the Pennine range. Storms and gales are more felt near the coast, as about the Furness district, or in the north of Cumberland near the Border and the Solway. These are principally from the west and south-west.

The mean annual temperature of Seathwaite (which is scarcely a favourable locality in the district to select, but is the only one, except Kendal, from which a return is available) is 46·7. This, though one of the lowest in England, is yet higher than those of Buxton and Macclesfield. In its mean minimum temperature however (41·0) Seathwaite compares favourably with Cheltenham and Southampton.

Kendal gives a mean of 47·5, which is less than 2° under that of Regent's Park.

The early winters are mild, and the springs fine. The least agreeable season for residence is from Christmas to the middle of March. As in other places, the spring and early summer months are the driest in the year. August is a wet month, and has been the cause of the prevailing idea "that it is always raining in the Lake District."

Rainfall.

This is large throughout the whole district, as may be seen at a glance from the Rainfall Map on p. 128. Perhaps indeed the greatest drawback to the region is the fact that its rainfall is excessive, and that within its limits is to be found the locality where the greatest fall in England is recorded, namely, Styé, in Cumberland, situated 1,077 feet above sea-level, and showing a rainfall of 182 inches in the year. Generally speaking, the rainfall increases with elevation up to 1,400 feet or thereabouts, and then diminishes at higher elevations. Nevertheless, Wastdale Valley, with a mean altitude of 1,716 feet, exposed to the south-west prevailing winds, has a mean rainfall of 79·8 inches; whereas Borrowdale Valley, on the other side of the watershed beyond the Wastdale Valley, and closed to the south-west winds, with a mean altitude of 1,044 feet, has a rainfall of 135·8 inches: showing that the clouds formed on certain mountains do not break until they have passed further inland. Within this district are places with no very excessive fall of rain. Yet in general the further into the heart of the mountains are the records taken, the more is the rainfall found to increase. Along the most populated valley or traffic route the rainfall is as follows:—

	Feet above Sea-level.	Rainfall in Inches.
At Flookburgh, Cartmel, Lancashire, on the coast near Leven Estuary	70	39·36
„ Wray, Lancashire on the edge of Windermere	165	53·54
„ Ambleside, Westmorland, at the north end of Windermere	227	80·27
„ Grasmere, Westmorland	556	86·68
„ Wythburn, near Dunmail Raise, Cumberland	580	105·90

This table shows an increase of rainfall as elevation rises, and also an increase the greater the distance from the sea.

The hills are no doubt factors in producing mists and clouds; they cause alteration of temperature by rapidly cooling the warm winds, and the rainfall is influenced thereby. This is recognized by the Dalesmen themselves, who explain the rainfall by saying, "It's t' hills as knocks boddens oot ut clouds."¹ From the tops of

¹ "It is the hills which knock the bottom out of the clouds."

the hills the production of clouds can be noticed on certain days, no cloud or mist coming up with the wind, but a thin streak of cloud appearing as the wind passes further inland. From mists and fogs the country is tolerably free; yet they do occur, as for instance over the surface of the lakes, tarns, and mosses, and in the valleys and woods towards evening, especially in early autumn, and to a less extent in spring, but not to the same extent as can be seen in the eastern fen districts of England. These mists usually clear away soon after sunrise: and it is not often in the year that the steamers on Windermere Lake, which start as early as 8.30 a.m., are prevented from running on account of the mist.

In winter heavy falls of snow but rarely occur. Severe frosts, if occurring, are generally observed in January and February: so that it is uncommon for any of the larger lakes to be frozen over sufficiently to allow of skating in December,—Windermere, for example, much more frequently freezes in January and February: and in 1895 remained frozen well into March. To be frozen over however at such a late date is quite exceptional. Indeed until this latter year it had not been known to occur within the memory of any living resident, although a similar occurrence is reported to have taken place in the beginning of the year 1814.

The dry months of the year are undoubtedly (as probably elsewhere) those of spring and early summer: for after a number of observations Windermere Lake has been noticed to have been lower in spring about Easter, than in either July, August, or September, for a number of years past, with the exception of 1887.

Rainfall in Westmorland.

The following table gives the rainfall records from Elterwater for sixteen consecutive years, 1862 to 1877 inclusive. It shows the rainfall per month, and proves that in this locality May is the driest month, while April, June and July come next. This explains the fact that Windermere Lake, as already stated, is lowest in spring, the Elterwater district being one of the great sources from which Windermere is supplied.

The second table¹ gives the records from three other localities, Windermere, Shap, and Appleby, and shows the total rainfall

¹ Symons' *Rainfall Tables of British Isles*.

RAINFALL IN WESTMORLAND.

TABLE I.

RAINFALL IN INCHES AT ELTERWATER, 244 FEET ABOVE SEA-LEVEL.

Year and Months.	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	Average fall per Month and year.	
January		9.94	9.72	7.60	8.36	13.39	11.07	8.80	12.32	7.30	6.97	19.75	20.09	13.06	17.58	6.50	17.17	11.91
February		2.53	5.26	6.08	7.53	10.44	9.09	8.43	13.56	7.03	10.69	10.83	1.72	6.18	2.50	10.81	7.49	7.49
March		6.14	4.08	6.42	3.68	6.49	3.91	11.03	1.61	4.20	6.10	7.60	4.80	8.27	3.19	9.94	4.90	5.77
April		9.71	6.03	2.54	1.98	3.09	9.92	5.18	4.46	3.11	4.48	2.81	0.62	3.46	2.82	11.61	4.40	4.76
May		5.06	5.81	2.76	9.32	2.52	2.97	3.35	2.84	7.07	2.05	4.01	4.18	1.95	4.57	0.77	6.43	4.10
June		7.58	5.94	4.90	0.71	3.92	1.87	1.36	2.92	2.26	2.58	9.97	4.77	2.40	6.86	5.62	6.45	4.38
July		7.44	1.53	3.63	3.54	4.96	5.50	0.68	3.10	1.79	6.58	5.18	11.62	4.32	4.32	3.38	10.27	4.87
August		4.81	7.15	6.14	8.48	8.72	5.61	8.97	3.00	2.57	5.85	6.01	10.38	15.23	5.50	8.58	9.55	7.29
September		3.21	13.01	9.87	2.78	11.35	7.11	3.38	16.03	7.11	3.73	15.63	7.19	10.53	10.54	6.95	5.20	8.56
October		18.49	10.08	4.57	8.61	4.97	9.18	11.88	5.22	15.02	8.97	12.47	13.69	22.02	8.50	7.09	18.25	11.16
November		3.22	9.19	8.42	8.90	11.44	1.95	6.12	13.30	6.35	3.61	13.05	4.49	8.36	10.01	6.64	19.16	8.43
December		12.33	8.73	11.55	7.11	12.76	6.00	17.94	12.42	3.45	11.16	12.95	7.32	6.92	8.81	13.08	11.99	10.40
Total fall per Annum.	90.46	86.86	74.68	71.90	97.05	74.51	87.02	90.78	67.89	72.72	119.86	91.32	101.90	87.20	90.23	174.62	89.12	

TABLE II.

RAINFALL AT WINDERMERE, SHAP, AND APPLEY.

	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
<i>Windermere.</i>										
135 feet above Sea-level	Ins. Days.	Ins. Days.	Ins. Days.	Ins. Days.	Ins. Days.	Ins. Days.	Ins. Days.	Ins. Days.	Ins. Days.	Ins. Days.
	69.77	200	73.46	240	61.25	240	61.25	240	61.25	240
<i>Shap.</i>										
85.2 feet above Sea-level	59.12	220	62.83	220	65.27	212	58.05	203	57.23	198
<i>Appley.</i>										
412 feet above Sea-level	36.32	188	37.87	219	37.49	193	31.18	191	25.28	175

* In the years 1881 and 1882 the rainfall was taken at a higher level, 451 feet above the sea.

in inches per annum, together with the number of days upon which rain fell. Of these four localities Elterwater and Windermere are on the western boundary, Shap is almost central, while Appleby lies more towards the eastern side of the county.

Rainfall in the Furness District of Lancashire.

To demonstrate the rainfall here, three localities have been chosen: two, Grange and Barrow, on the coast; one inland, namely Coniston.¹ The table (p. 209) gives the total rainfall in inches per annum, together with the number of days upon which rain fell.

Humidity.—In spite of the uniformity of the relative humidity, there are some considerable variations to be noted from the Meteorological Tables (see pp. 225–229), which refer however only to Cumberland.

Thus it will be noticed that Seathwaite returns the lowest figure, 81·3, and Stapleton the highest, 86·2, while next to Seathwaite comes the Alston return of 83·8. With reference to Seathwaite it has been pointed out by Mr. F. C. Bayard,² “that the relative humidity is remarkably low considering its abnormally high rainfall, a fact which seems to show that the rainfall has little or no effect on the percentage of relative humidity.” The total average humidity of the county, however, deduced from the records of the five stations referred to (see pp. 225–229), stands at 84·4, showing that the relative humidity, though not perhaps so great as might be expected from the rainfall, nevertheless reaches a high figure.

Vegetation.—The trees throughout the district dealt with in this Report, except in a few localities, are not fine, as compared with other parts of England. This may in some degree be due to the rocky nature of the ground. The trees cannot be said to afford protection, or to modify the climate, except in certain localities where there is much coppice-wood. The dwellings in and about the latter are apt to be somewhat damp, owing to the surface drainage of the soil becoming stagnant. The mists indeed hang about such places, especially in autumn, even when they are noticed at the same time to be absent from the less wooded or

¹ Symons' *Rainfall Tables of British Isles*.

² *Quarterly Journal of the Royal Meteorological Society*, vol. xviii., No. 84, Oct. 1892.

RAINFALL IN THE FETTERESS DISTRICT OF LANCAIRE.

	1875.		1876.		1877.		1878.		1879.		1880.		1881.		1882.	
	Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.
<i>Barrow.</i> 60 feet above Sea-level .	35.59	196	36.29	193	54.20	230	36.73	182	33.78	183	30.65	176	42.65	201	43.67	205
<i>Gramp.</i> 100 feet above Sea-level .	41.82	206	40.52	198	54.74	230	41.30	181	35.67	195	39.80	201	48.83	203	48.19	202
<i>Coniston.</i> 305 feet above Sea-level .	80.73	218	83.61	215	118.98	266	75.47	192	76.90	—	73.03	195	90.81	219	95.50	258
	1883.		1884.		1885.		1886.		1887.		1888.		1889.		1890.	
	Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.
<i>Barrow.</i> 60 feet above Sea-level .	35.20	191	32.94	182	32.67	185	47.30	215	21.28	157	34.72	191	36.26	197	46.12	198
<i>Gramp.</i> 100 feet above Sea-level .	42.12	221	40.61	204	37.12	201	53.41	228	27.86	170	34.33	208	38.54	200	44.59	224
<i>Coniston.</i> 305 feet above Sea-level .	92.26	219	81.82	215	84.61	171	87.56	—	51.45	128	70.84	165	74.77	202	83.91	211

more open parts. Until quite recently coppice-wood, especially birch, was valued and encouraged, for it provided the necessary wood for the bobbin mills, formerly one of the industries of this district, especially in Westmorland and Furness. This industry however is now rapidly dying out, owing to foreign competition.

The mildness of the climate throughout the district is evidenced by the vegetation, but varies much in different parts. Ferns, mosses and lichens grow to perfection in the damper portions, in certain situations the *Osmunda Regalis* reaching a height of 6 feet. Unfortunately the latter plant, in some parts of Cumberland, is much sought after by the poor, who regard fresh sections of the root, when rubbed over the muscles, almost a specific for lumbago. In times gone by also many local lichens have possessed a great reputation for hæmoptysis and diabetes, but in the latter disease only as a tonic and palliative remedy.

The greatest variation of vegetation is probably to be met with on or near the limestone districts.

The most tropical plants that can be grown in this region are found in the Furness district, on the north-west of the Morecambe Sands, in the sheltered limestone districts near the coast: especially where the limestone protects such localities from north, north-west and east, as for example about Grange. Here accordingly may be found growing out of doors *Azalia Indica*, *Habrothamus Fasciculatus*, *Eucalyptus Globulus*, the myrtle, and many other plants and shrubs, all evidencing the mildness of the climate in this region.

Around Windermere, which is on a higher level than Grange, only sheltered from the east, and possessing moreover a greater amount of rainfall than the latter by nearly 20 inches, the following plants may be found growing out of doors:—

Escallonia Macrantha, *Choisya Ternata*, *Ceanothus* and its varieties, *Hedera Madierensis*, *Aralia Sirbodii*, *Hydrangea Hortensis*, *Eucalyptus Globulus*, and *Cupressus Erecta Viridis*. Moreover in several places in the neighbourhood *Azalia Indica* may be found to flourish: while against sheltered walls *Magnolia Conspicua* and other varieties of the genus not uncommonly grow to a remarkable size.

In many places the vegetation thus indicates the mildness of the climate. In speaking more generally of the district as a whole, it may be said that any hardy shrub which can be grown out of

doors in England or Wales, will thrive equally well in the Lake District. It should be added too that the natural and characteristic colours of these shrubs are particularly well brought out in this district, possibly owing to the pure atmosphere, soft water and damp soil, which to so many of them are highly beneficial.

Water Supply and Sanitation.—The water supply is mostly provided from springs or reservoirs, and is excellent. In most cases it is abundant and soft. Where there is any local deficiency it might easily be remedied. Reservoirs situated in places almost free from contamination could supply the towns, as Thirlmere Lake now supplies Manchester and other large Lancashire towns. Wells are used in the agricultural districts, as for example the Eden Valley and the flat districts near the coast.

Drainage.—The water-carriage system has been adopted in most of the towns and more populous areas; yet in many of the smaller places the drainage is still primitive and defective, and has been described as “abominable.” Other places again have outgrown their drainage system, and suffer accordingly. Cesspools are as a rule in general use in the rural districts. For the disposal of sewage by means of sewage farms a great part of this district, owing to the rocky nature of the ground and rapid surface drainage, is not altogether adapted.

Prevailing Diseases.—*General summary of diseases noticed among residents throughout the district, as deduced from the returns made to the circular letters, and from some of the published Reports of the Medical Officers of Health.*

Anæmia and debility.—Both common; the former especially in young females, and amenable to treatment: the latter possibly due to mild climate and excessive rainfall. Some observers believe it to be commoner in wet winters.

Scrofula and tuberculous diseases, except phthisis pulmonalis.—Of average frequency; common in some districts, such as Kirkby-Stephen and Furness; uncommon in other places. Tubercular glands in the neck however seem to be common in children throughout the whole district. Speaking generally, tuberculous diseases are not supposed to be so common as they were some years ago.

Diseases of the Respiratory Organs.

Phthisis.—This disease occurs frequently in certain valleys,

while in other places, such as Kirkby-Stephen and Windermere, it is uncommon. At the latter, when cases are observed, they are for the most part imported. The Registrar-General's returns concerning phthisis show only the fatal cases, but several undoubted cases in an early stage have done extremely well in the Windermere district. On the whole the districts where phthisis is below the average are Wigton, Whitehaven, Cockermouth in Cumberland, and the west part of Westmorland: while those in which it is above the average are Ulverston and Furness in Lancashire, the Eden Valley and Bootle in Cumberland. Hamoptysis is not very common.

Bronchitis and Catarrh.—Common, especially in the two extremes of life. They are especially prevalent in the eastern portion of the district.

Pneumonia.—Of about average frequency: but appears to be rather more common in East Westmorland.

Pleurisy.—Simple pleurisy is not common. Concerning effusions—serous ones are uncommon, while empyemata are rare, especially in the rural districts.

Asthma.—Frequent in the eastern portion of Westmorland in those over forty, especially among females: not rare at Windermere.

Acute renal dropsy.—Rare, except when associated with scarlet fever or pregnancy.

Chronic albuminuria.—Rare.

Granular kidney.—Of moderate frequency, especially in the wealthier classes.

Calculus and gravel.—The former is very rare: some observers indeed have never seen a case. The latter complaint is also uncommon.

Rheumatism (acute) is in general uncommon. It is more often observed in the Eden Valley than elsewhere.

Rheumatoid arthritis.—Common, especially in the mild forms. Heberden's nodes are often seen; so also are distorted fingers in the aged.

Neuralgia.—Common, especially in the aged; rare in East Westmorland and in the Isle of Man.

Eczema.—Fairly common in East Westmorland; uncommon in other parts, except when occurring in infants, and then for the most part due to errors of diet.

Malarial affections.—Absent, except for occasional cases in the Solway marshes.

Typhoid fever.—Except in towns, practically non-existent. The returns show that it is less frequent in some of the more populated districts than was formerly the case.

Scarlet fever.—Of about usual frequency.

Diphtheria.—The observations made with regard to typhoid fever apply also to this disease.

Endemic sore throat.—Tonsillitis and non-specific ulceration of the throat are fairly common.

In addition to the above may be mentioned one or two other points of interest. For example, palpably rigid calcareous arteries are not very common, considering perhaps the number of cases of cerebral hæmorrhage and the great age of many of the inhabitants. Similarly, senile gangrene is extremely uncommon, at any rate in the neighbourhood of Windermere. Aneurysm also is very rare.

Carbuncles are of somewhat frequent occurrence in the district around Windermere. Biliary calculi are common. Caries of the teeth is very common, but most markedly in children with first dentition. The typical Dalesman has good teeth. Slight enlargements of the thyroid, cystic or otherwise, are very common about Windermere, especially in young women. Enormous goitres are rare. Insanity, considering the total population of certain out-of-the-way valleys—the valley of Troutbeck near Windermere, for example—has often been excessive. Syphilis, in the strictly country districts, is practically unknown. Gonorrhœa is rare. Illegitimacy, on the other hand, is common. Alcoholism is very prevalent, and yet, in spite of this, *delirium tremens* is not so frequent as might be expected.

The Mortality and frequency of Old Age among the Permanent Residents.—Longevity is common. The inhabitants often reach the age of 85, many live to over 90, and centenarians are not uncommon. In a death-rate table¹ given of the two parishes of St. Mary and St. Cuthbert, Carlisle, in nine consecutive years there were four centenarians. Not including those who die from old age, the usual causes of death are broncho-pneumonia, phthisis morbus cordis, malignant disease, chronic Bright's

¹ Hutchinson's *History of Cumberland*. 1794.

disease, and cerebral hæmorrhage. It has been stated by Haviland¹ that the mortality from cancer in females is below the average, in the district covered by this Report, and also that the Furness district of Lancashire possesses a somewhat remarkable immunity. Several observers however doubt, on strong grounds, whether these statements are really correct.

Death-rate.—Full details of the fatal results of the pathological influences at work in this district, can be obtained from the Tables in the Registrar-General's Reports.² From these data two tables have been compiled. The first, giving the mortality from all causes per 1,000 living in the various registration districts of the counties for the ten years, 1881–1890 inclusive, is as follows:—

TABLE I.

DEATH-RATE FROM ALL CAUSES PER 1,000 LIVING FOR THE TEN YEARS 1881–1890 INCLUSIVE, IN THE VARIOUS REGISTRATION DISTRICTS OF CUMBERLAND, WEST-MORLAND, AND THE FURNESS DISTRICT OF LANCASHIRE.

FOR ENGLAND AND WALES THE AVERAGE DEATH-RATE WAS 19·08.

CUMBERLAND Registration Districts.	Alston . . .	18·7	WESTMORLAND Registration Districts.	Kendal . . .	15·5
	Brampton . .	17·2		East Ward .	16·3
	Bootle . . .	15·3		West Ward .	14·6
	Carlisle . . .	20·0			
	Cockermouth .	18·7			
	Longtown . .	17·7	LANCASHIRE Furness District.	Barrow . . .	16·6
	Penrith . . .	16·4		Ulverston .	18·0
	Whitehaven .	18·9			
	Wigton . . .	16·9			

From the above it will be seen that in only one locality in the district, namely Carlisle, is the average death-rate for England and Wales exceeded, while in several it is very much below the average. The rate of mortality in the Furness district contrasts well with the somewhat heavy mortality of Lancashire as a whole.

The second table gives for the same period, 1881–1890, the mean population of Cumberland, Westmorland, and Furness, with the total number of deaths per 1,000, occurring in both male and female from various causes, together with a corresponding table dealing with England and Wales for comparison. (See p. 215.)

In considering the facts shown in these tables, it should be

¹ Haviland's *Geographical Distribution of Disease*. London, 1892.

² *Supplement to the 55th Annual Report of the Registrar-General*. Part I. 1895.

TABLE II.

DEATH-RATE PER 1,000 FROM VARIOUS CAUSES—BOTH MALE AND FEMALE, FOR THE YEARS 1881-1890 INCLUSIVE, IN CUMBERLAND, WESTMORELAND, AND THE FURNESS DISTRICT OF LANCASHIRE.

	Death from all causes.	Mean Population.	Variola.	Morbilli.	Scarlet Fever.	Typhlætheria.	Pertussis.	Typhus.	Enteric Fever.	Simple continued Fever.	Diarrhea and Dysentery.	Cholera.	Cancer.	Tubercle Mesenterica.	Phthisis.	DISEASES OF SYSTEMS.											Violence.	Childbirth.	Other causes.
																Other Tub. and Scroful. Diseases.	Nervous.	Circulatory.	Respiratory.	Digestive.	Urinary.	Generative.	Puerperal Fever.						
Cumberland	Male . Female	128,413 130,185	0.01 0.00	0.50 0.39	0.23 0.22	0.00 0.08	0.36 0.43	0.02 0.02	0.14 0.13	0.02 0.01	0.48 0.43	0.01 0.01	0.49 0.74	0.21 0.19	1.59 1.65	0.49 0.41	2.47 2.33	1.87 1.93	3.72 3.19	1.02 1.00	0.32 0.32	0.01 0.01	— 0.16	0.15	—	1.90 0.85	3.69 3.51		
Westmoreland	Male . Female	31,985 33,280	0.01 —	0.13 0.14	0.10 0.11	0.08 0.11	0.18 0.20	— —	0.14 0.16	0.03 0.01	0.27 0.19	0.01 0.01	0.74 0.74	0.12 0.12	1.45 1.45	0.38 0.38	2.08 2.08	1.81 1.81	2.22 2.22	0.03 0.03	0.23 0.23	0.08 0.08	— —	0.18	0.08	0.06 0.29	3.45 3.10		
Furness District of Lancashire (Ulverston and Barrow).	Male . Female	48,366 44,870	— —	0.74 0.70	0.17 0.20	0.13 0.15	0.32 0.47	0.00 0.01	0.39 0.39	0.10 0.06	0.50 0.53	0.02 0.01	0.24 0.51	0.25 0.23	1.20 1.56	0.38 0.36	2.26 2.23	1.26 1.28	3.75 3.28	1.21 1.24	0.37 0.25	— 0.05	— 0.20	0.18	—	1.06 0.26	2.94 2.49		
England and Wales.	Male . Female	13,346,401 14,142,081	0.05 0.04	0.47 0.41	0.35 0.32	0.16 0.17	0.42 0.48	0.02 0.01	0.21 0.18	0.02 0.03	0.71 0.61	0.02 0.01	0.43 0.74	0.30 0.25	1.85 1.61	0.47 0.37	2.80 2.39	1.55 1.60	4.10 3.38	1.15 1.06	0.56 0.32	0.01 0.10	— 0.16	0.13	—	0.57 0.35	3.60 3.29		

remembered that as a whole this district is for its size the most thinly populated part of England and Wales. The Furness district, for example, is about as thickly populated as Wales, containing 3.05 acres to each person. Cumberland shows 3.75 acres to each person, and Westmorland 7.71. Compared with the general mean, 1.36, for England and Wales, the difference is very striking. The general result of the tables is to show that in a number of diseases the death-rate compares favourably with the average figures for England and Wales. Malignant disease, on the contrary, is excessive in Cumberland and Westmorland, though less frequent in the Furness district. Phthisis is somewhat below the average, except among women, in Cumberland; but the women in the towns stay in their houses a great deal more than those in the country, and avoid fresh air. Diseases of the circulatory system show a high death-rate in Cumberland and Westmorland, but especially in the former. This harmonizes with the excessive amount of morbus cordis found in the Eden Valley in Cumberland, to which reference has already been made. Of the diseases of the respiratory system, the excess in Cumberland and the Furness district, compared with the low rate of Westmorland, may in no small measure be due to the fact that coal-working and mining are both carried on in Cumberland, and mining in Lancashire; whereas in Westmorland there is nothing of the kind, with the exception of a few-slate quarries. Puerperal fever is on the whole excessive. It is of average frequency in Cumberland, and above the average in Westmorland and Furness. Here again this may be due to the indifference of the inhabitants, and their neglect of the necessary precautions. Finally, it may be said that if a consideration of these tables shows that this district is a favourable one to live in, it cannot be claimed that this result has been attained in the past by any care on the part of the inhabitants to keep the various diseases from spreading, but rather to the three natural advantages of the district, namely, fine air, pure water supply, and a good natural surface drainage.

Therapeutic Effects.—The climate, owing to the excessive rainfall and dampness of the air, is “relaxing” within the ordinary meaning of such a term, nevertheless against this must be mentioned rapid natural drainage of the soil and the exhilarating nature of the mountain and moorland air. The coast is wanting

in the bracing climate found on the eastern shores of England; but on the other hand does not suffer from the biting east winds of spring and early summer to which the latter are exposed. The more open parts however are in January and February very bleak and cold.

Owing possibly to the effects of the Gulf Stream on the coasts of North Lancashire and Cumberland, the temperature of the whole region considered in this Report is very equable. In winter there is no extreme cold as is so often experienced in the midland and eastern counties; while heavy snowfalls such as occurred in January 1900, are quite exceptional. The average temperature at Windermere in November is said to be the same as that of Kent and Surrey during the same month; and the average temperature in December, January, and February, the same as that of Southampton during the similar months. This district as a whole affords excellent retreats for convalescence, especially in the spring and early summer months, and invalids who come for this purpose usually benefit rapidly. Patients going to the coast have the usual benefits which country seaside places offer. It is true that from its western aspect it lacks the cold bracing air of the east coast, but for that reason it is not so trying to certain cases as the east coast would prove in the early spring and summer. This coast in the winter is very bleak and dreary, and receives much rain with the south-west winds. **Grange** however is somewhat exceptionally situated, and possesses a milder winter climate, and is even visited by some phthisical patients on this account. An open-air sanatorium has recently been erected at Meathop, near Grange, but as yet has not been in existence long enough to compare its results with those situated in other parts of England.

The Isle of Man is more resorted to by holiday-makers than by invalids.

The Lake District is perhaps bad for asthma. Many visitors subject to the disease have attacks when coming here, and not a few have been unable to remain. Patients also who suffer from osteo-arthritis do not do well.

SPECIAL DESCRIPTION OF CERTAIN LOCALITIES.

WINDERMERE.

This lake, the largest in England, is considerably over ten miles long, and rather more than a mile across at its widest part. Three residential places are situated on its borders: **Ambleside** at the north end, and **Windermere** and **Bowness**, now practically one, on the eastern shore. It may be here mentioned that both Windermere and Keswick, centres for the southern and northern lakes respectively, return a relatively small rainfall.

Ambleside, Windermere, and Bowness are well sheltered from the east winds by the hills under which they are situated. All too are well protected by trees. Their populations have increased considerably in the last thirty-five years, and much has been done as regards drainage and water supply for the sake of the public health. As a result, while typhoid fever and diphtheria were formerly common, these diseases have now more or less disappeared.

The water supply is excellent. It comes from springs in the hills far removed from sources of contamination. The supply is sufficient and ample for many years to come, and there is no want of water even in dry seasons. The water itself is pleasant and soft. The drainage system in use is the water-carriage, and as most of the houses have been built since compulsory bye-laws were made, the condition of these places is healthy. In some cases however the soil of the filtration-beds is too porous, and the effluents are liable to pollute the lake. With the increase of building, before very long some new mode of sewage disposal will have to be adopted.

For visitors the accommodation in these and similar places is good, but that in the more out-of-the-way valleys is primitive. Both boating and yachting are to be had on the lake, but the fishing, except for charr (*Salmo Salvelinus*), is poor. Good golf links are to be found within a mile and a half of the lake. For bathing, the lake is not well adapted; the water, owing to its depth, being as a rule too cold.

THE HIGH LANDS ON THE SOUTH-EAST SIDE OF THE DISTRICT.

The climate of this area, in which is situated **Kirkby-Stephen**, offers a certain contrast to that of the remainder of the district already described. Here there is greater exposure to the east, and consequently the climate becomes more bracing. In March and April indeed the east wind blows so constantly and possesses so biting a quality, that it has been honoured with a special name, the "Helm Wind."¹ In these months consequently the climate is in this region somewhat trying. The winters as a rule are long, the springs short, but the autumns fine. The rainfall is relatively small, while mists and fogs are absent.

Concerning vegetation, it may be said that there is here a marked insufficiency in the cultivation of timber, consequently no modification of climate by trees. The natural drainage is good, one portion of the district draining into the Eden, which rises on the east side of Mallerstang Fells, while the remainder drains into the river Lune. The drainage proper of certain places is most unsatisfactory. The water supply is in several places collected on the moorlands, and is often dark and thick after rain, and is described as giving rise to flatulency, but otherwise is wholesome.

In this district morbus cordis and rheumatoid arthritis are unduly prevalent.

KENDAL.

Kendal is the largest town in Westmorland. It is situated on the river Kent, which here is liable to floods. These sometimes affect the town, as for example in November 1898. This town with a population of 14,900 inhabitants, chiefly of the working-class, lies in a hollow in the limestone more or less surrounded by hills. In some of the older parts of the town are to be found many primitive buildings in which the inhabitants still live. These are all ill-ventilated, and were not built to meet the modern ideas of public health. Reference is here made to the so-called "yards" which occur in many of the older towns, especially in Lancashire.

¹ See *Report on the Helm Wind Inquiry*, by W. Marriott. *Quarterly Journal of the Royal Meteorological Society*, vol. xv. p. 103.

These yards are cramped *culs-de-sac* into which several houses open, and where in their typical state ventilation is absent and drainage most primitive. Much however has been done in recent years to alter these conditions. The two chief epochs in Kendal's history, from a public health point of view, are the establishment of the Water Works Company in 1849, and the main sewage works, completed 1873. The Medical Officer of Health has published a table in his reports,¹ interesting from the fact that it dates back to the year 1838. Taking each five years separately, the summary of his table, giving the average annual mortality per 1,000 of the population, and also two of the meteorological means over the same period, is as follows:—(see Table p. 221).

The gradual diminution both in the general death-rate, and also in that from phthisis, variola and scarlet fever is very striking.

SHAP WELLS AND OTHER MEDICINAL SPRINGS.

Of the many medicinal springs situated within this district, and which two centuries ago possessed considerable reputation, one alone, **Shap Wells**, need at the present day be considered. The others have but an historical interest, and often indeed are now difficult to find. Shap Wells is situated almost in the very centre of Westmorland, on the eastern side of the main group of mountains, on nearly the summit of Shap Fells. This spring has been known for many years, and has been the subject of a medical treatise,² besides which many other authors have enlarged upon its beneficent properties. It is a saline spring of the following composition, one imperial pint containing³—

Calcium chloride	27·22 grains.
Magnesium chloride	·36 „
Sodium chloride	24·23 „
Calcium sulphate	·48 „
Sodium sulphate	1·72 „
Ferrum aluminium oxide	·08 „
Silica	·12 „

This analysis differs however somewhat from the one made in 1828 by Alderson.²

¹ *Borough of Kendal Annual Report*, 1898, R. M. Craven, M.R.C.S., L.R.C.P., D.P.H.

² *Chemical Analysis and Medical Treatise on Shap Spa*, R. Alderson, 1828.

³ The analysis here given was made in the Chemical Laboratory, Whitehaven, in 1881.

TABLE SHOWING THE MEAN TEMPERATURE OF THE AIR, THE RAINFALL, AND THE MORTALITY FROM VARIOUS DISEASES,
AT KENDAL, WESTMORLAND, FROM 1838-1898.

DATES.	POPULATION.	DEATHS—ANNUAL MORTALITY PER 1,000.								METEOROLOGY.			
		All causes.	Phthisis.	Varicella.	Morbilla.	Scarlet Fever.	Diphtheria and Membranous Croup.	Pertussis.	Typhus Fever.	Other Fevers.	Diarrhoea and Dysentery.	Mean Temperature of the Air.	Rainfall in inches.
Years inclusive.	Approximate.												
1838-40	11,800	31·0	4·9	20·3	11·3	37·6	—	5·0	5·3	14·0	1·7	45·643	50·644
1841-45	11,800	24·8	4·2	7·4	5·4	2·4	—	2·8	8·8	4·6	2·6	46·218	50·918
1846-50	11,800	28·0	3·8	1·4	2·8	14·2	—	1·6	17·0	6·4	5·8	46·938	51·704
1851-55	12,000	22·5	2·9	2·4	8·0	18·0	—	2·6	6·2	2·4	4·6	46·420	46·608
1856-60	12,000	20·8	2·9	1·6	7·4	2·0	—	4·2	6·6	1·8	1·0	48·079	44·701
1861-65	12,500	22·4	2·6	2	3·2	11·2	2	3·4	3·0	2·0	5·2	47·807	52·052
1866-70	13,000	22·4	2·9	—	9·4	13·2	4	4·4	1·8	1·4	6·4	48·061	51·806
1871-75	13,500	20·3	2·1	4·0	3·6	1·4	2·0	6·6	—	1·2	3·4	48·513	54·022
1876-80	13,000	20·1	2·3	8	7·0	12·4	2	3·0	—	—	4·0	47·330	49·931
1881-85	14,000	18·7	2·6	2	3·4	2·2	1·4	2·8	—	—	5·6	46·751	52·280
1886-90	14,000	18·0	1·9	2	4·4	8	3·2	1·6	—	—	4·2	46·105	44·134
1891-95	14,500	17·8	1·3	—	9·4	18	8	3·0	—	6	10·4	47·557	51·340
1896-98	14,900	14·9	1·06	—	7·6	3	4·0	3·6	—	—	6·0	49·084	51·853

Shap water has had a reputation in past years for being of service in skin affections, and also as a diuretic,¹ and was, a century ago, much "frequented by the people of the country for scorbutic complaints and eruptions of the skin."²

It is usually considered to be milder than the Harrogate purgative spa, and stronger than the Gilsland water which is in this district. Compared to other well-known waters in England, its properties are nearest allied to those of Leamington. The spring in this region is cold; but summer, and especially the autumn and early winter months, are mild and fine.

Shap, being thus situated, possesses a fine bracing mountain air, with no source of contamination near. It has not however gained the reputation which it may deserve, and this is perhaps accounted for by its seclusion and its distance from a railway-station; and also from the fact that it possesses none of the attractions commonly found at fashionable inland watering-places. Nevertheless to patients requiring absolute rest and solitude Shap may be warmly recommended in autumn and the finer months of the year.

Sir James Simpson, it may be added, used often to visit Shap, and declared "that it did him as much good as any place he used to visit, and was as stimulating as champagne." The Wells themselves are probably adapted to the same class of cases as those which receive benefit from the Leamington springs, the therapeutical uses of which have been already described in the previous volume of this work.³

THE ISLE OF MAN.

For the following Report on the Isle of Man the writer is indebted to Mr. C. S. Pantin, F.R.C.S., of Douglas. The east coast of the Isle of Man is hilly and exposed to the east winds but protected from the west. The climate of the island is variable. There is much wind, though but little fog. The range of temperature is small, but the mean temperature is high. The rainfall from three localities is shown in the following table, while

¹ *Chemical Analysis and Medical Treatise on Shap Spa*, R. Alderson, 1828.

² *Guide by Authors of Antiquities of Furness*, 1780.

³ Vol. I. p. 583.

RAINFALLS IN THE ISLE OF MAN AND CALF OF MAN.¹

	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
ISLE OF MAN. Douglas, 120 feet above sea-level .	47·54	50·05	43·46	38·96	38·91	49·10	26·98	38·03	35·06	43·43
Point of Ayre .	26·77	27·55	28·53	25·63	23·39	27·98	17·18	28·38	24·44	23·93
CALF OF MAN. Chicken Rock .	—	27·95	24·35	19·15	22·80	22·38	—	—	—	—

the succeeding one shows the average sunshine recorded at Douglas during the 10 years, 1881-1890.²

AVERAGE SUNSHINE AT DOUGLAS (CRONKBOURNE), ISLE OF MAN, 1881-1890.

MONTH.	Total Hours of Sunshine.	% of Possible Sunshine.	Total Hours of Sun- shine.	% of Possi- ble Sun- shine.
January	41·8	17	230·8	25·0
February	68·6	25		
March	120·4	33		
April	178·1	43	619·6	44·0
May	224·3	46		
June	217·2	43		
July	196·3	39	502·8	37·7
August	170·7	38		
September	135·8	36		
October	99·8	31	204·2	24·7
November	61·0	24		
December	43·4	19		
Average total for the year .	1557·4	32·8		

The soil for the most part is composed of either sand or gravel, with a hard rock subsoil. The elevations attain a height of 2,000 feet, and natural drainage is effected by many small streams. The trees are too few in number to affect the climate. Concerning the prevailing diseases mentioned in the circular letter, the returns from the Isle of Man contrast with the general summary of the district, already given, in the following respects:—

¹ Symons' *Rainfall Tables of British Isles*.

² For a comparison of this sunshine record with those from other stations see pp. 17-18, and especially pp. 125-127 and 174-176.

Anæmia and Debility, except when due to chlorosis or phthisis, are seldom met with among the residents. Visitors to Douglas, suffering from either, as a rule do extremely well.

Phthisis.—The death-rate from this disease is higher than the average rate for England and Wales. This undue frequency of phthisis must be attributed to many factors, but amongst them should be noted the frequency of close intermarriage among a small population; marriages between cousins, for example, being frequent. The population too has an unusual dread of catching cold. In consequence throughout the district the houses are ill-ventilated, and whole families often sleep in single rooms. No attempt too is made to prevent the dissemination of the disease by means of the sputum. The feeding of the country people again is extremely poor, potatoes and salted herring being the staple articles of diet.

Concerning *Hæmoptysis*, it is said that it is seldom entirely absent from cases of phthisis in the island. Commonly indeed it is severe, and not rarely directly leads to death. It is frequently the first symptom occurring long before any definite physical signs can be found in the chest.

Diphtheria is rare, and some deny that it is ever seen. *Insanity* is prevalent.

The drainage is at present unsatisfactory, consequently in Douglas enteric fever is endemic, and diarrhœa in every hot summer is severe.

The water supply is from mountain streams. It is soft, and is free from vegetable matter except after heavy rains.

Therapeutic Effects of the Climate.—For those who suffer from renal disease in any of its forms, and especially from tuberculous affections of the joints or bones, the climate of the island, and of Douglas in particular, is especially suitable. For cases of anæmia, and convalescents generally, it may also be recommended. For sufferers, however, from rheumatoid arthritis the climate seems unsuitable.

MONTHLY MEANS FOR THE SIX YEARS 1881-1886.

Station, ALSTON, CUMBERLAND. Height above Mean Sea-level, 1145 feet.

J. W. DICKINSON, Esq., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	Highest.	Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	49.8	-9.0	38.50	27.20	11.30	32.85	83.8	7.91	21.0	5.43
February	54.0	7.1	40.60	30.60	10.00	35.60	86.3	8.13	19.8	3.68
March	62.3	-2.0	42.43	27.78	14.65	35.10	85.5	6.98	19.6	4.56
April	70.5	15.8	48.65	32.86	15.79	40.75	81.3	7.30	18.8	3.44
May	76.8	22.6	54.83	36.23	18.60	45.63	76.0	6.65	17.5	3.51
June	77.8	27.2	61.36	41.58	19.78	51.47	77.3	6.95	16.1	3.20
July	80.4	32.8	64.38	46.10	18.28	55.24	81.1	7.65	19.8	4.75
August	81.8	27.0	62.63	45.28	17.35	53.95	82.8	7.18	17.8	3.21
September	72.8	24.7	58.48	42.91	15.57	50.69	87.0	7.00	20.0	4.54
October	65.2	13.8	49.83	37.53	12.30	43.68	89.6	7.48	23.3	5.26
November	66.3	16.4	44.01	33.31	10.70	38.66	89.0	7.73	21.0	4.73
December	55.2	3.0	38.90	27.53	11.37	33.21	86.6	7.30	20.6	4.83

MEANS FOR THE SIX YEARS 1881-1886—QUARTERLY AND YEARLY.

Station, ALSTON, CUMBERLAND.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.					Mean Temperature of Air.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	Highest.	Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	62.3	-9.0	40.51	28.52	11.98	34.51	85.2	7.67	60.4	13.67
April—June	77.8	15.8	54.94	36.89	18.05	45.01	78.2	6.96	52.4	10.15
July—Sept.	81.8	24.7	61.83	44.76	17.06	53.29	83.6	7.27	57.6	12.50
Oct.—Dec.	66.3	3.0	44.24	32.79	11.46	38.52	88.4	7.50	64.9	14.82
Whole year	87.8	-9.0	50.38	35.74	14.67	44.95	83.8	7.33	255.3	51.14

1 Highest and Lowest=Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE SIX YEARS 1885-1890.

Station, NEWTON-REIGNY, CUMBERLAND. Height above Mean Sea-level, 579 feet.

J. G. BENN, Esq., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	SUNSHINE.		Mean Cloud (9 a.m.).	RAIN.	
	Highest.	Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.			Total Hours.	% of Possible Sunshine.		Days it fell.	Inches.
January . . .	34.0	6.8	41.96	31.70	9.76	36.58	91.3	38.5	16.1	7.91	20.3	3.49
February . . .	50.2	7.5	41.48	30.41	11.07	35.94	96.5	62.6	22.3	7.25	14.3	1.89
March . . .	64.3	9.5	44.18	31.51	12.67	37.84	88.0	97.3	26.8	7.46	17.3	2.16
April . . .	69.0	23.3	50.01	35.05	14.96	42.53	81.0	136.1	32.5	7.66	15.3	2.01
May . . .	76.0	27.8	56.93	40.30	16.63	48.61	80.0	172.1	34.6	7.56	17.1	2.93
June . . .	82.0	30.5	63.08	43.88	18.60	54.98	78.1	207.6	40.5	6.60	11.6	1.42
July . . .	80.5	34.0	64.70	48.30	16.40	56.50	78.1	180.8	35.3	7.45	16.8	3.12
August . . .	76.3	31.0	62.88	47.41	15.47	55.14	79.8	141.0	30.8	8.01	16.3	2.69
September . .	73.8	28.2	59.80	43.98	15.82	51.89	83.6	129.8	34.6	7.03	16.3	3.04
October . . .	66.3	21.0	51.81	39.51	12.30	45.66	87.8	72.1	22.6	7.70	19.1	3.77
November . .	58.1	18.2	46.23	35.30	10.93	40.76	91.5	44.1	17.8	7.86	18.5	3.60
December . .	54.8	10.8	40.36	30.18	10.18	35.27	91.6	30.3	14.1	7.71	17.1	2.82

MEANS FOR THE SIX YEARS 1885-1890—QUARTERLY AND YEARLY.

Station, NEWTON-REIGNY, CUMBERLAND.

MONTH.	TEMPERATURE OF AIR.					Mean Temperature of Air.	Mean Relative Humidity (9 a.m.).	SUNSHINE.		Mean Cloud (9 a.m.).	RAIN.	
	Highest.	Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.			Total Hours.	% of Possible Sunshine.		Days it fell.	Inches.
Jan.—Mar. . .	64.3	6.8	42.37	31.20	11.16	36.78	89.9	198.4	22.1	7.54	51.9	7.54
April—June .	82.0	23.3	56.97	40.24	16.39	48.60	79.7	515.8	35.9	7.27	44.0	6.36
July—Sept. .	80.5	28.2	62.46	46.56	15.89	54.51	80.5	451.6	33.6	7.50	49.9	8.85
Oct.—Dec. .	66.3	10.8	46.13	34.99	11.13	40.56	90.3	146.5	18.2	7.76	54.7	10.19
Whole year . .	82.0	6.8	51.98	38.24	13.64	45.41	85.1	1312.3	32.4	7.51	200.5	27.46

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.

Station, SCALEBY, CUMBERLAND. Height above Mean Sea-level, 111 feet.

R. A. ALLISON, ESQ., M.P., J.P., F.R.Met.Soc., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	54.5	-7.0	42.54	32.48	10.06	37.51	88.9	7.80	10.0	2.58
February	58.0	14.9	43.93	33.12	10.81	38.52	89.5	7.43	15.0	1.73
March	67.0	12.0	46.22	32.95	13.27	39.58	87.1	7.08	16.9	2.37
April	69.0	23.0	51.81	36.13	15.74	44.00	80.0	6.90	13.7	1.72
May	77.5	27.4	59.27	41.47	17.80	50.37	79.5	6.51	14.5	2.10
June	82.5	31.0	64.85	46.55	18.30	55.70	79.4	6.60	12.8	2.28
July	81.7	37.9	66.22	49.88	16.34	58.05	81.3	7.47	19.4	3.98
August	83.0	32.7	65.09	49.11	15.98	57.10	83.3	7.29	17.3	3.43
September	82.5	27.4	61.96	46.28	15.68	54.12	84.8	6.91	17.2	3.08
October	66.7	20.0	53.37	40.27	13.10	46.82	89.0	7.01	18.8	2.89
November	60.0	19.6	47.48	36.27	11.20	41.88	91.2	7.34	20.0	3.47
December	57.5	6.0	41.72	31.57	10.15	36.64	91.3	7.57	16.2	2.57

MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.

Station, SCALEBY, CUMBERLAND.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.					Mean Temperature of Air.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	67.0	-7.0	44.23	32.85	11.38	38.53	88.5	7.43	50.9	6.68
April—June	82.5	23.0	58.66	41.38	17.28	50.02	79.6	6.67	41.0	6.10
July—Sept.	83.0	27.4	64.42	48.42	16.00	56.42	83.1	7.22	53.9	10.49
Oct.—Dec.	66.7	6.0	47.52	36.04	11.48	41.78	90.5	7.30	55.0	8.93
Whole year	82.0	-7.0	56.71	39.67	14.03	46.68	85.4	7.15	200.8	32.20

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1881-1890.

Station, SEATHWAITE (CUMBERLAND). Height above Mean Sea-level, 422 feet.

W. DIXON, ESQ. and MRS. HUGHES, Observers.

MONTH.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	54.6	6.9	42.19	33.85	8.34	38.02	85.2	8.24	20.1	13.57
February	55.7	18.4	42.93	33.85	9.08	38.39	87.3	7.87	16.9	11.44
March	65.8	12.0	44.63	36.58	11.05	39.10	85.5	7.48	18.9	10.66
April	70.5	21.6	50.89	37.44	13.45	44.16	76.9	6.96	14.5	6.43
May	77.3	28.8	58.10	42.95	15.15	50.52	73.3	6.92	15.9	8.57
June	85.6	35.0	63.87	48.46	15.41	56.16	74.7	6.90	14.1	6.80
July	81.1	40.4	63.76	51.30	12.46	57.53	77.4	8.06	21.0	11.44
August	82.0	55.3	63.35	50.36	12.99	56.85	79.6	7.85	19.2	8.80
September	76.2	32.3	59.97	47.54	12.43	53.75	82.9	7.56	17.9	12.10
October	71.8	23.0	52.98	41.27	10.81	46.67	83.0	8.03	19.0	11.23
November	62.8	21.4	46.46	38.10	8.36	42.28	85.6	8.30	20.6	14.75
December	54.6	12.5	41.55	33.39	8.16	37.47	85.5	7.81	20.3	13.20

MEANS FOR THE TEN YEARS 1881-1890—QUARTERLY AND YEARLY.

Station, SEATHWAITE, CUMBERLAND.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.					Mean Temperature of Air.	Mean Relative Humidity (9 a.m.).	Mean Cloud (9 a.m.).	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	65.8	6.9	43.25	33.76	9.49	38.50	86.0	7.86	55.9	35.67
April—June	85.6	21.6	57.62	42.95	14.67	50.28	74.9	6.92	44.5	21.80
July—Sept.	82.0	32.3	62.36	49.73	12.63	56.04	79.9	7.82	58.1	32.34
Oct.—Dec.	71.8	12.5	46.69	37.58	9.11	42.14	84.7	8.04	59.9	39.17
Whole year	85.6	6.9	52.48	41.60	11.47	46.74	81.3	7.66	218.4	148.88

¹ Highest and Lowest=Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE FOUR YEARS 1881-1884.

Station, STAPLETON, CUMBERLAND. Height above Mean Sea-level, 400 feet.

A. W. STIRLING, ESQ., M.B., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January	33.0	2.00	41.32	31.00	10.32	36.16	90.5	8.37	18.5	3.88
February	55.1	20.5	48.57	33.60	9.97	38.58	92.0	8.73	18.2	3.12
March	64.1	14.0	44.95	32.27	12.66	38.61	87.7	7.65	18.2	3.18
April	62.7	23.0	51.47	35.67	15.80	43.57	81.0	7.37	15.2	2.15
May	78.5	30.0	58.10	40.30	17.80	49.20	76.7	6.35	14.0	2.76
June	81.7	31.9	62.17	45.40	16.77	53.78	77.5	7.72	15.0	4.29
July	78.4	37.0	64.10	49.62	14.48	56.86	82.7	7.90	23.2	5.86
August	79.9	37.5	63.67	48.70	14.97	56.18	85.2	7.47	16.2	3.99
September	70.8	35.2	60.42	46.57	13.85	53.49	87.5	7.25	19.0	3.55
October	64.5	21.9	52.50	39.82	12.68	46.16	89.0	7.15	19.0	3.29
November	58.2	21.3	46.05	35.17	10.88	40.61	91.0	7.60	21.2	4.95
December	56.5	17.1	41.50	31.62	9.88	36.56	94.0	8.12	18.7	4.10

MEANS FOR THE FOUR YEARS 1881-1884—QUARTERLY AND YEARLY.

Station, STAPLETON, CUMBERLAND.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.					Mean Temperature of Air.	Mean Relative Humidity (9 a.m.)	Mean Cloud (9 a.m.)	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March	64.1	14.0	43.28	32.29	10.99	37.73	90.0	8.25	54.9	10.18
April—June	81.7	23.0	57.24	40.45	16.79	48.85	78.4	7.14	44.2	9.20
July—Sept.	79.9	35.2	62.73	48.29	14.43	55.51	85.1	7.54	58.4	13.40
Oct.—Dec.	64.5	17.1	46.68	35.53	11.14	41.11	91.3	7.62	58.9	12.34
Whole year	81.7	14.0	52.48	39.14	13.33	45.87	86.2	7.63	216.4	45.12

1 Highest and Lowest = Absolute Highest and Lowest in Period.

THE CLIMATE OF NORTHUMBERLAND, DURHAM AND YORKSHIRE

By W. S. LAZARUS-BARLOW, M.D., F.R.C.P.

PART I

GENERAL DESCRIPTION OF THE COUNTIES AND THEIR CLIMATE

THE district comprised by the counties of Northumberland, Durham and Yorkshire, is irregularly triangular in shape. Speaking roughly the triangle is right-angled at its western extremity, that is to say, its western boundary runs in a direction from north to south, while the eastern boundary, starting at Spurn Head, runs upwards from east to west at an angle of about 60° with the base-line. The boundaries of the district are, on the east, the German Ocean: on the west, the Cheviot and Pennine ranges of hills, beyond which lie the counties of Berwick and Roxburgh in Scotland, and Cumberland, Westmoreland and Lancashire in England; on the south are the counties of Derby, Nottingham and Lincoln, from the latter of which the district is separated by the river Humber. The total area comprised by the counties now under consideration is close upon 8,600 square miles. The coast-line, measured in a direct line across the map from Tweedmouth to Spurn Head, is about 180 miles. In reality however it is much greater, if calculation be taken of the natural sinuosities of the land.

General Physical Characters. — Speaking generally, the district slopes downwards from its western to its eastern side: but the rapidity of the descent varies in different parts. Thus in Northumberland and Durham the area of land less than 250 feet above the sea-level is comparatively a small proportion of the area of the two counties, and lies close along the coast. In Yorkshire

on the other hand the land falls rapidly in the middle of the county to below 250 feet above the sea-level, but rises again though to a less height in the eastern moorlands and the Yorkshire Wolds; thence it does not fall to any extent, but is instrumental in forming the high cliffs that characterize the middle three-fifths of the Yorkshire coast. The valley thus existing between these two ridges of high land constitutes what is called the "Plain of York," and extends from the valley of the Tees down to the Lincolnshire fen district; the eastern highland is represented in Lincolnshire by the Lincoln Wolds. Nevertheless the land is distinctly low between the eastern moorlands and the Yorkshire Wolds, and again between the Yorkshire Wolds and the Lincoln Wolds, as is shown by the fact that the river Derwent runs its course towards the sea between the former pair, while between the latter pair is found the river Humber. The coast-line of the district therefore is flat from Tweedmouth to Hartlepool, where is found the only very prominent headland which occurs along Northumberland and Durham, continues to be flat past Redcar, but begins to rise at Saltburn, thence it continues to rise past Whitby and Robin Hood's bay, reaching a height of sometimes 500 and occasionally 800 feet, falls somewhat at Scarborough and Filey, but rises abruptly at Flamborough to about 450 feet, whence it falls rapidly past Bridlington Quay, until at Hornsea and Withernsea the sea-shore and the land form a surface in which any slope is imperceptible.

The western side of the triangle is mainly composed of the hills of the Pennine range which in the northern portion of Northumberland is intersected by the Cheviot Hills. This side therefore is composed of uniformly high land which in the main is over 1,500 feet above the sea-level, while at various points it rises into mountainous peaks, of which Cross Fell (2,900 feet) just in the borders of Cumberland, Baugh Fell (2,216 feet), Whernside (2,414 feet), Ingleborough (2,373 feet), and Pennegent may be mentioned. This mountainous tract of country terminates in the Peak district of Derbyshire. The Cheviot Hills occupy a circle of about fifteen miles in diameter, which is chiefly within the county of Northumberland, between the Scottish border on the north-west and the upper part of the river Coquet on the south. Cheviot, the chief mountain of this range and the one which gives its name to the

whole chain, is 2,658 feet above the sea-level. Interspersed between these peaks is a large quantity of moorland, which extends eastwards for some distance into the centre of the district.

We may now shortly consider the physical characters of each of the three counties that compose the district under consideration.

In *Northumberland* the surface is generally level about the sea-coast, but more diversified towards the middle, rising into gently swelling ridges separated by the principal rivers: these districts are in a few places adorned with woods and plantations. The western side, in general, is open and mountainous, growing little else but heath and affording only scanty subsistence to the flocks that are there pastured. There is a general lack of old woods throughout the county though there are some thriving plantations.

The general aspect of *Durham* is hilly and mountainous, particularly the western angle, where however the Pennine Hills do not rise to any considerable height. From the eastern side of these hills issue numerous streams which flow towards the sea: and smaller ranges of hills branching off from the district spread in various directions over the county. Teesdale presents a long and winding strip of fertility surrounded by some of the wildest country in the kingdom. This valley is more than thirty miles in length, and here the principal lead-mines are situated. Weardale is also a wild and romantic district: and Tynedale on the northern border may vie with either in natural beauty while it is greatly superior in its cultivation. The central parts of the county include some beautiful and fertile valleys, and are pleasantly varied with hill and dale, alternately appropriated to the growth of corn and to pasturage. The eastern coast is bare and dreary, intersected by chains of limestone whose monotonous forms, destitute of wood, and frequently ploughed to their summits, render the district singularly uninteresting to the eye. Between the swells of the county however lie numerous dales or denes almost entirely concealed from the higher ground.

The geographical features of *Yorkshire* are strongly marked. The North Riding is distinguished by a bold and rocky coast, while further inland successive ranges of hills, rising one above another, form the elevated tracts of the moorlands, and present a dreary and desolate aspect of hopeless sterility. Further westward appear the extensive vales of Cleveland and York,

and beyond them the western mountains and moorlands. The East Riding is the least interesting in the county, and with the exception of the Wolds exhibits no prominent variations in the appearance of the country. The West Riding is exceedingly irregular in its surface; so far westward as Sheffield, Bradford and Otley, it rises into hills and is beautifully varied in aspect, while further westward still it becomes very mountainous and rugged, though it is occasionally intersected with beautiful valleys.

From the foregoing considerations it is seen that the district comprising Northumberland, Durham and Yorkshire, is well sheltered on the west, north-west, and south-west, from winds coming from those directions. But north-east, south-east, and south winds are practically unobstructed over most of the district. In fact winds coming from any easterly quarter have free and unimpeded access to the whole region, and the only portion sheltered from them—and that only to a slight extent—is that portion of the Plain of York immediately to the west of the eastern moorlands and the Yorkshire Wolds. The bearing of these facts will need detailed study later on.

The chief wealth of the district we are now considering lies in its mines, and consequently the geological formation is inextricably mixed up with them. Coal, lead, and iron are found in abundance. The system of stratification, to which the coal-fields of *Northumberland* and *Durham* belong, commences on the primary rocks in Westmoreland, Cumberland, and the Cheviot Hills. Its lowest stratum is in some places a red gritty schist, imbedded with large balls of ironstone sandstone and schist. The lower and middle courses of strata are various in their thickness, and consist of schist limestone and sandstone of unequal specific gravity, but generally very solid and compact. While the limestone continues the coal is in thin seams and of a soft and sulphurous quality; but as soon as the highest courses appear (which consist chiefly of alternate beds of schist sandstone and coal) the veins of coal are more numerous, thicker, and of a very superior quality. The coal-seams and the rocky strata, which together constitute the "Newcastle coal formation," are partly covered by the magnesian limestone, and rest upon the lead-mine measure. They occupy a hollow or trough, of which the extreme length from Acklington colliery near the Coquet to Cockfield near West Auckland, in the

adjoining county of Durham, is fifty-eight miles, and the breadth from Bywell on the Tyne to the sea-shore is twenty-four miles. This formation bounds the coast from the mouth of the Coquet to the Tyne, and after crossing the latter river the magnesian limestone begins to cover a part of it, and continues to intrude more and more upon it, until both approach the Tees. The lead district of Northumberland is a bleak and rugged region of mountains, extending from Northumberland and Durham into Cumberland and Westmoreland, and thence to the extremity of Derbyshire, being about 160 miles in extent. The veins however partly lie so low that they are unprofitable. Iron ore is found both in the coal and the lead districts. Immense quantities of iron pyrites lie imbedded in the strata of indurated clay through all the coal-field, and are profitably supplied from the collieries to the iron-works in the coal district. Ironstone is still more abundant in the shale of the lead-mines. Zinc ores abound in most of the plumbiferous veins. Copper is also found in these and in the coal measures, but does not repay working. Trap rocks occur in both coal formations, and a small district along the Tweed is occupied by the new red sandstone. The coal of Durham is chiefly found in the east and north-east portions of that county, and at the termination of the coal district the lead-mines begin: some of the latter have been worked since the sixteenth century. The strata in Durham are partly those in which the coal-fields lie, viz. coal, shale, and sandstone, but millstone grit, so called because it is used in the manufacture of the celebrated "Newcastle grindstones," is found in the neighbourhood of Gateshead, and a beautiful black limestone marble, thickly set with white coralloid fungitæ, is quarried at Frosterley, while iron ores are to be found almost over the whole county. The magnesian limestone district begins at South Shields and runs along the coast to Hartlepool, south of which the red sandstone district begins and extends to above Croftbridge.

In the North Riding of *Yorkshire* the minerals chiefly consist of the alum-mines on the coast of Whitby, and the lead-mines in Swaledale and the neighbouring valleys. Excellent freestone or grit is found in many parts of this Riding. A long but narrow ridge, producing lime of a quality peculiarly good for agricultural purposes, extends along the edge of the eastern moorlands. Marble of various kinds is found in many parts of the western moorlands,

but is converted to no other uses than those of making lime and repairing roads. Coal is found, but the supply is small and the quality bad. In the East Riding chalk is the principal fossil substance. The mineral productions of the West Riding consist of coal, iron, and stone, while lead is extracted from the mines of Grassington and Pately-bridge. In this Riding four clearly-marked divisions show themselves. The Levels on the east rest on the stratum of red sand and clay, with gypsum or alabaster in varying qualities. The magnesian limestone range is one great plain rising from beneath the Levels, and terminating towards the west in a regular well-defined edge, forming the partial summit of drainage. In the south is the Great Yorkshire and Derbyshire coal-field, which rivals or even surpasses in importance that of Northumberland. The mining district is, in some parts of the north, exceedingly variable in features, occupying either high or low ground, and producing or not producing metallic ores.

The *Soils* to be found in Northumberland, Durham and Yorkshire, are principally loam and clay. In Northumberland the soils are very various; some parts are fertile and well cultivated, while others are almost barren. On the sea-coast and in the vales of Breamish, Till, and Bowmont a sandy loam or turnip soil is found. Around the Cheviot Hills in the north-west is a dry gravelly loam, with fine green hills thrown into a vast variety of forms, enclosing and sheltering many deep narrow and sequestered glens. The Cheviots are celebrated for their sheep pastures. Towards the centre and south-east of the county moist loams on a wet clayey bottom prevail, while a black peat earth occupies most of the mountainous districts and some of the lower parts of the region. In Durham the soils are generally loam. Near the river Tees, and in some spots bordering on the other rivers and brooks, the soil is loamy or a rich clay; at a further distance from these it is of a poorer nature, commonly called "water shaken," with spots of gravel interspersed, but these are of small extent, none of them being more than a mile across. The hills, between the sea and an imaginary line drawn from Barnard Castle on the Tees to Clansford on the Derwent, are for the most part covered with a dry friable loam, the fertility of which varies in proportion to its depth: from this line west the summits as well as the sides of the hills are moorland wastes. In the North Riding of Yorkshire the

soil along the coast is brownish clay and loam: the hills abound with alum-shale. The district of Cleveland has a very fertile clay, and a fine red sandy soil. The vale of York both in soil and fertility is very variable: Swaledale, on each side of the river Swale, is extremely fertile. The surface of some of the higher hills of the eastern moorlands is entirely covered with large masses of freestone, and extensive morasses and peat bogs highly dangerous to pass. In the West Riding the soils vary from a strong deep clay or loam to the worst peat earth. In the East Riding there is a light loam, with a mixture of gravel in the sheep district of the Wolds. The flat country, extending between the Wolds, the Ouse and the Humber, to Hull and towards Spurn Head, along the side of the Humber, chiefly presents a sandy soil, and in fact in the neighbourhood of Withernsea and Hornsea is almost pure sand.

Natural drainage is well provided for throughout the district under consideration, and the rivers are most of them broad and many of them navigable for some distance. The rivers of Northumberland are the Tweed, the Till, the Alne, the Coquet, the Wansbeck, and the Tyne, all of which flow in a more or less easterly direction from the high land on the north and west of the county. The rivers of Durham are the Tyne, which forms a natural boundary for the county from Northumberland, the Wear, and the Tees, which forms the southern boundary. The Wear is a fairly large river, but the main drainage of Durham is by means of the Tyne and Tees. Along the course of the latter river is the well-known valley of the Tees, or Teesdale, in which all kinds of trees grow in great luxuriance. The dale is a narrow one with precipitous edges at the bottom of which the river runs. The drainage of Yorkshire is almost entirely carried out by the Ouse and its tributaries. The Ouse is formed by the confluence of the Swale and the Ure, which run southward after having drained the northern parts of Yorkshire: it is joined by the Nidd, at York by the Foss, then by the Wharfe, and from Selby onwards by the Derwent, the Aire, and the Don, all of which are considerable rivers. Besides these there are many smaller streams throughout the district, which assist in procuring natural drainage, but which are not of sufficient importance to call for notice. The Esk however, which runs through the town of Whitby, and which we shall consider again when dealing with that place, may be mentioned.

Vegetation.—The counties of Northumberland, Durham and Yorkshire are not thickly wooded as a whole, though parts produce many trees of various kinds. This is no doubt due in some degree to the fact that the district is largely a mining one, but principally to the fact that the exposed nature of the country is unsuitable for prolific growth. Nevertheless the valleys, and in particular Swaledale and Teesdale, are thickly wooded, and there is abundance of old timber in the many gentlemen's estates, which are found especially in the northern portion of Yorkshire. In other parts the growth of trees is hindered, and they appear stunted. The effect of the climate is well seen in an example noticed at Saltburn. In the gardens, which have been laid out on the banks of the Burn, there is great shelter and much moisture, so that the climate is very similar to that met with in the south-west of England; here vegetation is very luxuriant, and besides the trees which grow well there is an abundance of undergrowth. In particular the fronds of the common fern were noticed to measure four feet from rhizome to tip, whereas a specimen of the same fern, found on the high ground and fully exposed, measured but little over a foot. Fungi and mosses of various kinds are not at all uncommon in certain parts, notably in the neighbourhood of Darlington and Barnard Castle; while along the course of the rivers lichen is everywhere to be found. The crops are distinctly later in ripening than in the south of England, and this is very noticeable in passing rapidly through the country. Thus in travelling from London northwards, the crops were in August for the most part cut, and a large proportion gathered in, over the more southern portion of the journey, while from Leicestershire northwards they were still standing or in a few places being cut, and in Northumberland they were not nearly ready for harvest, in some parts being still quite green. Nor is there the same profusion of wild flowers that those, who are well acquainted with the south-west of England, are accustomed to see, and if one pass direct from the south of Devonshire to the district under consideration the difference in this respect is most marked. In a word so far as vegetation is concerned, the north-east appears to be fully a month behind the south-west. It must be borne in mind however that these differences only obtain in parts, and that in sheltered spots vegetation seems to run far more nearly in a line with Devonshire,

a fact which would tend to show that the climate of Northumberland, Durham and Yorkshire is such as it is, not so much from a less supply of heat as from a diminished storage, a feature easily accounted for by exposure and easterly winds. Nearer to the western limits of the district, where the land lies higher and is much exposed, vegetation is largely confined to heath furze and bracken, while grass itself is stunted and affords poor pasturage; land such as this extends for miles, and there are but few trees to break the monotony. This difference between the western and middle portions of the district is nowhere better seen than in the neighbourhood of the river Wear. Durham city for example is surrounded by trees, and about Barnard Castle the country is well wooded, while Rokeby and Raby Castle grounds show that the climate is not unsuitable for the growth of large timber. On the other hand, the western portion of Durham is almost entirely mountainous waste.

Ocean Currents.—The effect of *Ocean Currents* upon the climate of the district cannot be very great, for the warmth-giving Gulf Stream does not make itself felt to any extent upon the eastern coast of England, and particularly upon the north-eastern coast. But the length of the sea-board and the considerable distance that intervenes between the coast of the district under consideration and the nearest land in an easterly direction do have an important bearing on the climate. It is well known that air that has travelled over land is colder than air that has travelled over water, and as a matter of experience the east winds of Lincolnshire are far more piercing than those of Yorkshire at the same time of the year. No doubt this is largely owing to the fact that in the southern parts of Lincolnshire the winds have unimpeded access, while in Yorkshire there is a certain amount of protection given by the Yorkshire Wolds and the eastern moorlands. But a reference to the map will show that the distance from, for example, Whitby to the nearest land in an easterly direction, viz. Denmark, is about double that between Boston and the nearest land due east, which is in Holland, a little north of Amsterdam. In the same way the east wind in winter at Saltburn is often a relatively warm wind, while the south and south-west winds, having come over the moors, which are entirely covered with snow, are bitterly cold. Another important

point, which has a direct bearing on the example just given of the difference between the east winds in Lincolnshire and Yorkshire, is found in the fact which is shown by the *Meteorological Atlas*, namely, that the temperature of the surface of the sea on the Lincolnshire coast is two degrees colder than that on the Yorkshire coast, in the neighbourhood of Scarborough, during all the months of the year excepting June July August and September. For some reason, that is not quite clear, the mean temperature of the sea surface about Scarborough is, throughout the year, warmer (in some months as much as 3°) than at places both north and south of that town; nevertheless the difference between the average yearly temperature of the sea-surface at Scarborough and on the east coast of the Shetlands, which are 6° of latitude further north, is less than 2° , while in the winter months of December January and February the temperatures are identical, except that there is a difference of 1° in January, and that is in favour of the Shetlands. Passing to the other extreme of the British Isles by way of comparison, the *Meteorological Atlas* shows that there is a difference between the average temperatures for the year of the sea-surface at Scarborough and at the Scilly Isles (4° of latitude further south) of over 5° , while during the winter months there is a difference of 8° in favour of the Scilly Isles. This being the case it is certain that the mean temperature of the air on the Yorkshire coast has more characteristics of a northern than of a southern nature, and for the purposes of this Report the importance of this point can hardly be exaggerated. With the exception of the neighbourhood of Scarborough, the temperature of the sea-surface at other parts of the coast of Northumberland, Durham and Yorkshire is very nearly the lowest of any around the British Isles, nor do any considerable differences show themselves over the whole eastern coast of Great Britain from the mouth of the Thames to Caithness. The actual temperatures of the sea-surface vary from 40° off the coast of Durham in January to 57° off the coast of Scarborough in August. The greatest increase is of 5° between April and May, and the greatest decrease, also of 5° , is between September and October.

Climate, etc.—In attempting to arrive at an idea of the climate and meteorology of Northumberland, Durham and Yorkshire, use has been made of the information given in the

¹ Meteorological Society's Tables concerning the following places:—Northumberland; Alnwick, 213 feet above the sea-level and 34 miles north by west of Newcastle; Cramlington, 255 feet above the sea-level and nine miles north-north-east of Newcastle. Durham; Ushaw, 600 feet above the sea-level and four miles to the west of the city of Durham. Yorkshire: Rounton, in the North Riding close to the confines of Durham, 242 feet above the sea-level and six miles south of Yarm; Aysgarth, in the North Riding near the confines of Westmoreland, 658 feet above the sea-level and about 18 miles south-west of Richmond; Scarborough, 129 feet above the sea-level, also in the North Riding and in the same latitude as Aysgarth; Bradford and Halifax in the West Riding a few miles from the boundaries of Lancashire, and respectively 366 feet and 530 feet above the sea-level, and Hull in the East Riding, 12 feet above the sea-level. Thus, on the coast or near to it, we have Alnwick, Cramlington, Ushaw (which also partakes of the character of moorland), Scarborough and Hull; in the centre is Rounton, and in the western or mountainous portion are Aysgarth, Bradford and Halifax, although Bradford in some respects partakes of the characters of the central portion of the district.

The average temperature for the whole district, measured from all the above-mentioned stations, is 46·014, the mean of the highest 52·834, and of the lowest 40·066. The mean temperature at a station in the north of London for the twenty years ending 1880 was 50·6. The temperature given as the mean for the district (46·014) shows that for the British Isles the district is a cold one, and inasmuch as over half of the stations are near the sea-coast, while one-third at all events are situated on high ground, the probability is that the effect of the cold air of the hills is counterbalanced by the warming effects of the sea, and therefore that the estimate of the mean temperature of the air is a fairly accurate one. It must however be well borne in mind that local differences obtain and modify the general average often to a great extent.

The climate of Northumberland is distinctly bracing, but the temperature is subject to great variations and generally changes to extremes. Thus, in January 1881 the absolute minimum temperature recorded was just above zero in the Fahrenheit scale, and the highest in the same month was 49·7, a range of nearly 50.

¹ For an analysis of these Tables see pp. 277–285.

At Cramlington on the other hand the absolute minimum for January was in the year 1886, when the thermometer fell to $15^{\circ}\cdot 1$, while the absolute maximum in that month was $50^{\circ}\cdot 8$, giving a range of $35^{\circ}\cdot 7$. The monthly range for Alnwick is $32^{\circ}\cdot 7$, and that for Cramlington $29^{\circ}\cdot 72$. It must be remembered however that the meteorological statistics for Alnwick are only available during the years 1881-2-3, and that in all probability the very large range of January 1881, has raised the average to too great an extent, and consequently that the range is really much less. In point of fact in 1882 and 1883 the ranges at Alnwick and Cramlington were respectively $22^{\circ}\cdot 2$ and $24^{\circ}\cdot 3$ in 1882, and $26^{\circ}\cdot 1$ and $26^{\circ}\cdot 8$ in 1883. Nevertheless the fact remains that the extremely low temperature ($0^{\circ}\cdot 1$) referred to above, which was registered at Alnwick, is the lowest of any recorded at the nine stations chosen for this inquiry with the sole exception of one of $-2^{\circ}\cdot 8$, which occurred at Aysgarth in the same year (1881). In like manner the range at both Alnwick and Cramlington in summer is very considerable. Thus in July, which is the hottest month at both places, the monthly range at Alnwick is $31^{\circ}\cdot 17$, and at Cramlington $36^{\circ}\cdot 18$, while at both places in that month minimum temperatures of under 30° have been recorded. The daily range however is not so considerable, being very nearly 16° . In January the mean daily range is slightly over 10° . Consequently it appears that in Northumberland, even fairly close to the sea, the temperature of the air may fall to an extreme extent in comparison with the season of the year, and that the daily range must not be regarded as an entirely trustworthy gauge of the temperature likely to be found in any one month, but that this must be considered in connection with the monthly range. In the western parts the climate is even more severe, but no statistics are available. The mountains are covered with snow for months together when none is to be seen in the lower districts. The variations, as will be seen later, are not confined to any one season. It may not be out of place to quote the words of a quaint old writer on the "new state of England," who in 1690 thus delivered his ideas, on the question of the climate of Northumberland. He says, "The air of this county is sharp and piercing in winter, and sometimes troubled with deep snows and pinching frosts suitable to its climate. But yet 'tis nothing near so sharp as the people. And by my late experience here wet weather is not so sensible and searching as it

is in Middlesex. 'Tis possible the warm breaths that continually come out of its numberless coal-pits helps with the vapours of the sea to take off the rawness of a cold dampish air." The yearly temperature of the county, judged from Alnwick and Cramlington (45·38), is slightly lower than the average (46·014) for the whole district comprising Northumberland, Durham and Yorkshire.

The only statistics from which an idea of the climate of Durham can be formed, are those at Ushaw, which are hardly suitable, inasmuch as the station is 600 feet above the sea-level. Nevertheless it will be well to consider them separately, as they will give some conception of the climate met with on the moors, and consequently will supply to some extent the information that is lacking concerning the western portion of our district. They have been taken since 1885, and therefore the averages used are those of five years (1885-9 inclusive). The mean yearly temperature at Ushaw is 45·25; the mean of all the highest 51·38; the mean of all the lowest 39·11. The lowest temperature recorded is 18, the highest 80·2. The monthly range for January is 31·62, for July 35·9, being greater than that at Cramlington in winter and less in summer. The mean daily range at Ushaw for the year is 12·27, that for Alnwick and Cramlington 13·66. It is worth noting in this connection that the mean temperature of Aysgarth (658 feet above sea-level) is 45·12, and that the daily range for the year is 12·38. The great difference between night and day temperatures, with which one would expect to meet on this high land, does not appear, probably because the constant presence of cloud, and the effects that clouds have upon humidity and rainfall and maximum and minimum temperatures, all tend to equalize the night and day temperatures, and thus abolish the great differences which would otherwise show themselves. Moreover it must be remembered that sensation of temperature only bears a very indefinite relation to absolute temperature as registered by the thermometer. The influences of humidity and of winds are very important; thus, though the temperature, as indicated by the thermometer, in winter may be comparatively high, the co-existence of a very dry wind blowing with some degree of force, by producing a greatly increased evaporation from the body, will lead to the opinion that the temperature is lower than is really the case, while the same actual

temperature, if there be no wind and the humidity be high, will from the diminished evaporation lead to the idea that the temperature is higher than it really is. When the temperature as registered by the thermometer is low, and a moist wind is blowing, there is produced the sensation popularly known as "rawness." These considerations must be borne in mind in estimating the temperature or climate of any place, but particularly when moorland temperature is being examined. A clear night will infallibly be colder on the moors, just as a clear day will be hotter than on low land (eliminating the question of wind for the time being), and this fact, combined with the prevalence of cloud over moorland, will explain the seeming inconsistency between the smallness of the mean daily range for the year at Ushaw and Aysgarth and the great differences that are felt by persons living on the moors for any length of time. Speaking generally, the air of Durham is not so cold as might be expected in a county so far north; the shelter given by the western hills, and the comparative length of the sea-coast mitigating its rigour to a considerable extent. Nevertheless, in spring and autumn, when fogs are very common and lie over the valleys for days together, the air has a "raw" quality, and in winter when the wind blows over the snow-laden hills it is often bitterly cold.

The variations in the climate of Yorkshire are no less great than those of Northumberland and Durham. In the vale of York the air is mild and temperate, except near the moors. The Howardian hills are cold. Ryedale, and the marshes on the skirt of the Derwent, enjoy a mild but damp air. The great altitude of the eastern moorlands renders their climate extremely cold. That of the vale of Cleveland is somewhat severe, though from the use of lime and the dryness of the soil the harvest is not late. The climate of the western moorlands is colder and more moist than the eastern. The eastern side of the Yorkshire Wolds is naturally colder than the western side. The levels in the western part of the East Riding, as well as the eastern part of the West Riding, both of which lie on the two sides of the river Ouse, enjoy a mild air, though from the presence of the river and the fact that this portion of the county lies in a hollow, there is considerable prevalence of fogs and the air is very moist. In the middle portion of the West Riding the air is sharper and clearer, while in that portion which

borders on the counties of Westmoreland and Yorkshire it is cold, tempestuous and rainy.

Temperature.—The average temperature for Yorkshire, obtained from the stations chosen in that county, with the exception of Aysgarth, is $46^{\circ} \cdot 6$, or rather more than half a degree above the general average for the whole district of Northumberland, Durham and Yorkshire, or if Aysgarth be included it is $46^{\circ} \cdot 35$, or but one-third of a degree above the average. With the local differences therefore that have just been indicated, and which will be referred to when the various resorts, etc., are considered in detail, the subject of the temperature of Yorkshire may be dismissed with the statement that for all practical purposes all that has been said concerning Northumberland and Durham may be taken as holding good for Yorkshire also.

Humidity.—The average humidity of the district under consideration is $83^{\circ} \cdot 810$, varying from $87^{\circ} \cdot 027$ at Rounton to $79^{\circ} \cdot 450$ at Bradford. Bradford, Hull and Halifax, all of which lie on the eastern sides of ranges of hills and are therefore sheltered from the westerly or rain-bearing winds, have a low humidity, while Alnwick, Scarborough, Crumlington and Rounton, which are fairly open on the west, have a high humidity. The humidity of Aysgarth is slightly below the average, that of Ushaw above, but both come side by side in the middle of the series. The lower humidity of Aysgarth has to be corrected by the fact that it comes highest in the scale of rainfall, while Ushaw only comes fifth, there intervening between them places such as Halifax and Bradford, whose positions, and probably also their manufactorial activity, give them an increased rainfall, and Alnwick, which owes its high rainfall to its proximity to the Cheviot Hills, and its situation to the leeward of the whole of the manufacturing district of Northumberland.

Rainfall.—The estimation of the average rainfall of any large district is open to two grave sources of error: (1) local differences may be considerable, and therefore the number of places where measurements are taken may be totally inadequate to represent the real rainfall of the district; (2) the difference between places distant from one another but a few miles may be so great as to make an average of only very minor value. Bearing these points in mind, and also another fact, that the part where the greatest amount of

rain falls (viz. the western mountainous portion) in the district is by no means adequately represented in the nine stations that have been chosen, we may briefly state that the rainfall of Northumberland, Durham and Yorkshire is below the average, being 30·975 inches in the year against 39·76 inches for the British Isles generally. According to the *Meteorological Atlas* it appears to have the lowest rainfall, with the exception of that portion of the East Coast of England which lies between the Humber and the Thames. In the western portion of the district, including also the eastern portion of Westmoreland and Lancashire, the *Meteorological Atlas* gives the rainfall as increasing up to 40 inches, while in the Lake District it reaches to 50, 60 and even 70 inches. The *Atlas* however specifically states on the map that "a much larger amount is known to fall in some places, more particularly on mountain slopes, of which no such record exists as to admit of its being shown on so small a map." Inasmuch therefore as a very large proportion of Northumberland, Durham and Yorkshire consists of such "mountain slopes," there is every reason to believe that the rainfall stated (30·975 inches) is under rather than over the mark.¹ The average number of days on which rain falls (a fall of ·006 inch being defined by the Meteorological Society as such a day) is less open to objection, for though the quantity of rain deposited at spots close together may, and does, vary within wide limits, the actual character of the weather is usually fairly constant over considerable areas. The average number of days on which rain falls in the district we are considering is 191·68, or over 50 per cent. of the year. The number is lowest at Ushaw (178·8) and highest at Aysgarth (205·2). At Bradford the total amount of rain deposited is slightly under the average (30·89 inches), but inasmuch as rain falls on 201·6 days out of the 365, there must be a very frequent fall of drizzling rain and this, bearing in mind the situation of Bradford on the slope of the Pennines, is *à priori* probable.

Winds.—It is somewhat difficult to tell what is the exact proportion in which the wind comes from the various quarters in the district, for in certain cases the returns to the Meteorological Society are simply tabulated under the headings of north, east, south and west, whereas in others the cardinal points are sub-

¹ This view is supported by the opinions of the late Dr. Symons, F.R.S. and of Dr. Alexander Buchan, F.R.S. See the Rainfall Map constructed by the latter on page 128 of this volume.

divided, so that, in addition, the wind is noted as coming from the north-east, north-west, south-east and south-west. There is no doubt however that actually winds coming from the westerly quarter are the commonest, and south-west winds appear to be commoner than north-west. Of the nine stations, winds are referred to eight points of the compass in five, viz. Alnwick, Cranlington, Aysgarth, Rounton and Scarborough; they are referred to the four chief points in three, viz. Bradford, Halifax, and Hull, while from Ushaw no return is made. Moreover in each of the five stations above-mentioned observations are taken twice daily, and no notice is taken of cases when there is a calm. At the three stations mentioned in the second place, the general direction of the wind for the day is registered. It is therefore impossible to collect them into one aggregate mass, and they must be dealt with in two series. Of the 730 possible observations in a year, an average of 656·7 is obtained as those on which wind from some quarter is observed, and therefore 73·3 the number on which there was a calm. Of these 656·7 observations 151·6 refer to south-west winds, 118·6 to west winds, 89·7 to north-west winds, 69·8 to south, 65·3 to north, 64·7 to north-east, 54·0 to south-east, and 43·1 to east winds, or for purposes of comparison they may better be regarded as percentages and the figures would run thus:—South-west 23·3 p.c., west 18·3 p.c., north-west 13·8 p.c., south 10·7 p.c., north 10·0 p.c., north-east 9·9 p.c., south-east 9·9 p.c., and east 6·6 p.c. South-west, west and north-west winds therefore taken together account for over 55 per cent. of the observations, while we may assume that there was calm in one out of every ten observations. In the second series, comprising Hull, Halifax, and Bradford, in the year there are north winds on 70 days, east wind on 74·7 days, south winds on 92·7 days, and west winds on 127·7 days. The strength of the wind can be gauged from four stations only, viz. Hull, Scarborough, Halifax, and Bradford. In a scale measuring from 0 to 12 (7 and greater than 7 being a gale) the average strength for these four stations is 1·30. At Bradford and Halifax, which are well sheltered by the hills on their western side, the strength is only 0·79 and 0·78 respectively, while at Scarborough it is 2·28.

Sunshine.—No direct statistics upon the amount of sunshine are available at any of the stations, and an idea can only be

indirectly obtained from consideration of the mean amount of cloud. Cloud is calculated in the Meteorological Society's Tables by a scale from 0 to 10 : if less than 2 the sky is regarded as "clear," if more than 8 as "overcast." The average cloud for the whole district is 6·6, varying from 6·145 at Hull to 7·118 at Bradford. The absolute minimum was in March 1883, when the mean cloud at Hull was only 3·8 : the absolute maximum in January 1884, when at Bradford it was 8·7. Bradford and Halifax, from the same causes which lead to the small strength of the wind and an increased rainfall, show the greatest amount of cloud. Ushaw and Aysgarth come next in order, and this partly explains the comparatively small range of temperature to which reference has already been made : Alnwick, Scarborough and Hull are at the other extreme, and consequently enjoy the greatest amount of sunshine : Alnwick, because the cloud is largely precipitated and causes the heavy rainfall noted there, the rain coming down in heavy showers while the sun appears between them, Scarborough and Hull from the greater strength of wind which obtains at those places and therefore disperses the cloud. In addition there comes in the important factor that the temperature of the air at Scarborough and Hull is above the average throughout all four seasons of the year, and therefore that the air can hold a larger amount of water in suspension.

Fog.—The district is somewhat liable to fog in autumn and early winter, while mist in summer is common along the course of the various rivers. In the neighbourhood of Barnard Castle, fog often lies for days together in the numerous valleys and renders locomotion extremely difficult. The vale of York also is subject to fog. Owing to the stillness of the air, mists are common in those parts of the district which are protected from the wind ; but beyond this further indications are unnecessary, as protection from wind has already been considered.

Character of the Climate in different Seasons.—In endeavouring to come to some conclusions as to the character of the climate met with in Northumberland, Durham and Yorkshire during different seasons, the year has been divided into the natural seasons, viz. spring, summer, autumn and winter, while the months that have been regarded as constituting these seasons have not been taken in the usual way, but in that which corre-

sponds most nearly with their climatic characters. Thus spring is in the subsequent description always to be taken as meaning the three months March, April and May; summer, as June, July and August; autumn, as September, October and November; and winter, as December, January and February. Of course at the beginning and end of each series the climatic characters are by no means accurately indicated by the averages, but a division being necessary it has been thought better to take the temperature of the air rather than the duration of daylight as the criterion by which the seasons should be measured, especially as the question of external temperature is of such vital importance where a report is being made with the avowed intention of considering the value of various resorts as health-giving places for persons who are or have been under medical care.

SPRING.—In spring the average temperature of the whole district during the ten years 1880-9 was 43·358, the mean of the maxima being 50·952 and that of the minima 36·757, the range of temperature being therefore over 14°. The mean temperature of the air at a station in the north of London for twenty years (1861-1880) was 44·6, or nearly a degree and a quarter higher than the district under consideration. Though apparently small this number does not fully express the difference. This is better indicated by the lateness of vegetation which obtains in the northern district. Considerable differences however show themselves between individual places; thus Bradford has a mean maximum of 51·87, a mean minimum of 39·3, and a mean temperature of 44·4, whereas Halifax which is only a few miles distant has a mean maximum of 52·30 (or half-a-degree higher), a mean minimum of 36·70 (or two and a half degrees lower), and a mean temperature of 43·2 (or one and a fifth degrees lower). It is curious to note that on comparing the averages of these two places during the months constituting spring, with the sole exception of May 1886, the mean minimum temperature at Halifax was lower during each month than that of Bradford for the corresponding month, while the number of occasions on which Halifax had the highest mean maximum was double that in which the contrary was the case. From the nearness of the two places and the general similarity of their surroundings, such a difference between their temperatures would not have been anticipated. It

probably, in part at all events, depends upon the fact that the station at which the Halifax calculations were made is 164 feet higher above the sea-level than that at which the Bradford calculations were made. The place that is absolutely the warmest out of the nine stations used in this inquiry is Hull with a mean maximum of $52^{\circ}87$, a mean minimum of $36^{\circ}90$, and a mean temperature of $44^{\circ}83$. The coldest is Cramlington (255 feet above the sea-level), where the mean maximum was $50^{\circ}15$, mean minimum $35^{\circ}77$, and mean temperature $42^{\circ}25$.

Cloud.—The amount of cloud over the district in spring is below the average for the year, and in point of fact is less than in any other season. It may therefore be concluded that the amount of sunshine is the greatest. The actual amount of cloud is 6.54, varying from 6.00 at Scarborough to 7.19 at Ushaw.

Humidity and Rain.—The humidity of the district in spring is below the average for the year, being 81.57 ; it is not so low however as in summer. Humidity in spring is lowest at Bradford (77.80) and highest at Rounton (86.58). The rainfall in spring is the lowest of all the four seasons, though the actual number of days on which rain falls is somewhat greater than in summer. There is no very considerable difference between the various places in the series with regard to rainfall in the season now under consideration, the amounts only varying between 5.88 inches at Rounton and 7.77 inches at Ushaw, and the number of days on which rain fell between 40.0 at Alnwick and 49 at Ushaw. In all cases, with the exception of Scarborough (where the difference however only amounts to .081 inch), March is the month in which the greatest amount of rain falls, though, excepting Aysgarth and Alnwick, the number of days on which there is no rain is greatest in April.

Winds.—With but very few and minor exceptions, north, north-east and east winds show their greatest prevalence during this season, and south, south-west and west winds are the least frequent. Not however that the actual number of days on which one of the former set of winds blows is greater than that on which the latter set blows, for this only occurs in the case of Scarborough, where winds from northerly and easterly quarters are very common. Nor is this unintelligible, on account of the situation of the town. The strength of the wind during spring is slightly above the average for the year; but does not very

greatly vary from that obtained in autumn and winter. The average strength shows a considerable difference between Halifax where it is 0·79 and Scarborough where it is 2·54.

Summary.—To sum up, the climate of Yorkshire, Durham and Northumberland in spring is cold but dry, as compared with London and the rest of the British Isles; there is a considerable prevalence of winds blowing from the east and north; these however are not always so cold as those blowing from the west and south-west, because in early spring these last-mentioned winds have just come over the moors which are often covered with snow. The wind blows with a considerable amount of force in the neighbourhood of the coast, and as a result those inhabitants of the towns on the seashore, who can do so, leave their homes and journey inland and southwards. There is a fair amount of sunshine, but the power of the sun's rays is not at that time of the year capable of counterbalancing the effect of the east and north-east winds, which indeed are the dominating characteristic of spring in the north-east of England.

SUMMER.—The mean temperature of the air during summer over Northumberland, Durham and Yorkshire is 56·285, the mean of the maxima being 64·860, and that of the minima 49·169. The range therefore is over 15°. Compared with the station in the north of London already referred to, the mean temperature of Northumberland, Durham and Yorkshire is over six and a half degrees cooler (62·83). London however in summer is hotter than almost all places on the coast of Great Britain (about 2° warmer than Torquay for example), and warmer than most inland places. Hull again shows itself to have the highest mean temperature (57·73) and also the highest mean of all the maxima (67·50); but with regard to the minima Bradford (52·10) and Scarborough (51·63) both come in front of Hull, where it is 49·47. Alnwick has the lowest mean temperature (54·97); though the mean of the maxima is about the average, the mean of the minima is lower.¹ Bradford and Halifax show the same differences as in spring, but they are intensified. The mean temperature of Halifax (56·0) is one and a third degree lower than that of Bradford

¹ Statistics for Alnwick are only available during the years 1881-2-3; after that date they were discontinued. Too much weight therefore must not be given to the statement in the text.

(57°33'), nevertheless the mean of the maxima at Halifax is a degree higher than that of Bradford. The mean of the minima however is three and a half degrees lower. The mean maxima in the sun at Halifax is 105°3, while at Bradford it is only 86°2. At Hull it is 100°8.

Cloud.—The amount of cloud in summer is greater than in either spring or autumn, not quite so great as in winter. This seems to depend upon the large amounts of cloud at Halifax, Ushaw, and Cramlington, which outbalance the small amounts at Scarborough, Rounton and Hull. Nevertheless it is only at Aysgarth and Bradford that the amount of cloud in summer is less than that at any other season in the year. It is reasonable to expect a large average of cloud from the considerable amount of high land that there is, particularly in the western portion of the district, where clouds lie over the hills for days together. An important point moreover lies in the manufacturing character of the district and the numerous furnaces that exist. Over Sheffield, Middlesborough and Newcastle, for example, clouds were noticed with great constancy, whereas a few miles away from each of these towns the sky was cloudless. With regard to sunshine it is very difficult to speak with certainty on account of the absence of definite statistics, but at all events in summer the writer is of opinion that the district under consideration, as a whole, is not less sunshiny than the generality of English districts; it is not so cloudy in his opinion as Devonshire and the south-west of England, nor so sunshiny as Lincolnshire and Suffolk, while the Lake District with the counties on the west of the Pennine range have as a rule decidedly less sun.

Humidity.—Humidity in summer over the counties of Northumberland, Durham and Yorkshire is in every case below the average for the year, though at Scarborough and Rounton not markedly so. At Bradford, on the other hand, it is ten points below the average for the town itself. The summer average for the district is 79·54.

Rainfall.—The rainfall in summer is greatest of any during the four seasons with the exception of autumn; it measures 7·856 inches. The number of days on which rain falls is however the least during summer, amounting to 43·71 days, against 53·29, 48·49, and 46·2, in autumn, winter and spring respectively. The

largest rainfall (10·32 inches) occurs at Aysgarth, the smallest (6·229 inches) at Scarborough. Aysgarth also is characterized by affording the largest number of rainy days (50), but rain falls on fewer days at Cramlington, Rounton, and Halifax, than at Scarborough.

Winds.—During summer the winds that prevail are those from the west and south-west, and there is a marked diminution in the prevalence of east and north-east winds. Nevertheless at Halifax, Cramlington, Rounton, and Scarborough for example, it may be seen that the characteristic of spring has not entirely been changed, so that at these four places in summer north-east winds, though much less common than in spring, are more common than in autumn and winter. The strength of the wind in summer is at its lowest point, being 0·68 at Bradford and Halifax and 1·93 at Scarborough.

Summary.—Summer in Northumberland, Durham and Yorkshire is colder than it is in England generally, nevertheless from the lowness of the humidity there is not the rawness that is found in, for example, Westmoreland. The wind is not so strong as at other times of the year, but close to the sea it blows with some force. When the sun is shining brightly, and there is little or no wind, the heat may be extreme, though from the greater lack of shelter from wind it is rarely so hot as in the south of England. Practically the difference in sensation of temperature between Yorkshire and other parts in summer resolves itself into the question of exposure to and protection from wind. At Saltburn for example in sheltered parts on a hot summer day the weather is sub-tropical, while on the same day in exposed parts of the town, though in the full glare of the sun, one may feel cool and fresh.

AUTUMN.—The mean temperature during autumn over the district under consideration is 47°·0, varying from a mean maximum of 53°·315 to a mean minimum of 41°·611. The range therefore is nearly 12°. Temperature is highest at Scarborough (48°·33), and this is owing not so much to the mean of the maxima (as regards which it comes in the middle of the series of nine places chosen for the inquiry), but to the fact that its mean minimum temperature (44°·13) is two and a half degrees above the average. Temperature is lowest at Aysgarth, from the fact that the mean of the maxima is one and a half, and the mean of the minima one degree, below the respective averages. It is by no means uncommon

for frosts to occur during September, but Bradford, Halifax and Scarborough are noted as having no temperature below freezing recorded during that month. At Rounton out of seven years a temperature below freezing has been recorded in September in three.¹ In October however frosts become common, and not one of the nine stations is exempt from them, although Scarborough still shows that in seven Octobers out of ten the temperature never fell to freezing. At Aysgarth in the recorded years an October has never passed without frost. The mean temperature of London (north) during autumn is $50^{\circ}6$, a difference of $3^{\circ}6$.

Cloud.—The average amount of cloud over the district is 6.56, an amount slightly exceeding that in spring, but less than that in either summer or winter. During this season Hull shows its minimum (5.90), which also is the absolute minimum for any season at any of the nine stations. At Bradford, on the other hand, the average cloud during autumn is 7.17, or considerably above the general average for the year.

Humidity and Rainfall.—The average humidity however is increasing and by the greatest amount of any season, namely, from the 79.54 of summer to 85.95. At the same time the amount of rainfall and the number of days on which rain falls also increase. They are 9.244 inches and 53.29 days respectively. The humidity is not at its highest point in autumn, but the rainfall is, and that too at every station with the exception of Bradford.

The difference in rainfall between summer and autumn varies within rather wide limits, thus it is only .4 inch at Cramlington and .3 inch at Rounton, while at Halifax it is over 3 inches. At Bradford the fall is rather greater than at Halifax, but the summer rainfall (10.32 inches) being so excessive the autumn average (11.640 inches) does not show so great a difference.

Winds.—Westerly winds still continue to be the most common, but easterly winds again show an increase in frequency, though to nothing like so considerable an extent as in spring. The strength of the wind also increases and is greater than in spring, much greater than in summer, but not quite so great as in winter.

¹ Only the absolute lowest in the month is recorded on the chart, consequently though it can be said that during 1880-9 there was never frost at Bradford, Halifax and Scarborough during September, it cannot be stated with regard to the other stations upon how many occasions in this month a temperature below 32° F. was reached.

Summary.—Autumn in Northumberland, Durham and Yorkshire is a cold season, but there is not the great difference between summer and autumn that is noticed in other parts of the country. Thus in many years September and the early part of October really form a late continuation of summer; September in particular is often a very fine month. The most unpleasant part of the season is towards the latter end of October. November, though cold, is often very fine and bright, and in the middle of the day may be fairly warm; at Hull, for example, the mean of the maxima in the sun is $58^{\circ}1$. Nevertheless, it is only in sheltered spots that outdoor lounging in November is possible. Fogs and mists in the morning and evening become very common, more so than at any other time of the year. In the neighbourhood of Barnard Castle during late autumn fog often lies in the valleys for days together.

WINTER.—In winter the mean temperature of the air is $37^{\circ}415$, the mean of the maxima being $42^{\circ}208$, and that of the minima $32^{\circ}729$. The range is therefore about nine and a half degrees. The mean temperature of the air for the same season in North London is $39^{\circ}7$, or slightly over two degrees above that of the district under consideration. The highest winter average is at Bradford ($38^{\circ}93$), and no doubt is due largely to the amount of cloud that covers the town. The lowest ($36^{\circ}10$) is at Ushaw, and owes its occurrence to the small amount of cloud observed here at this season of the year, and also to its elevated position. January, which is as a rule the coldest month, often shows extremely low temperatures; thus there was an absolute minimum at Hull in 1881 of 6° F., at Alnwick in the same year the absolute minimum was 0° F., at Aysgarth in the same year $-2^{\circ}8$ F. Nevertheless the absolute minimum for January is not nearly so low as those figures would indicate, although it is fairly low, being $21^{\circ}9$, or 11 degrees of frost. The mean of the maxima in the sun's rays for Bradford, Halifax and Hull during winter is nearly 54° ; at Hull, which is the coldest of the three places in this respect, (though not so, as far as regards the mean winter temperature of the air,) it is $51^{\circ}7$, or six and a half degrees lower than the corresponding temperature in autumn.

Cloud.—The cloud over the district is now at its greatest ($6^{\circ}67$), and varies from $7^{\circ}58$ at Halifax to $5^{\circ}93$ at Alnwick, at which places the amounts are the maximum and minimum respectively for the

four seasons. There is a considerable difference between different stations in this respect during winter; thus at Cramlington, Rounton, and Alnwick, this season is the period of the least amount of cloud; at Halifax, Scarborough, Bradford, and Aysgarth, on the other hand, it is the period of the greatest amount.

Humidity and Rainfall.—Humidity is also now at its greatest (88·2), varying from 90·87 at Ushaw to 85·7 at both Bradford and Hull. It is four and a half points above the average for the year, and with the exception of Alnwick is greater at every station than at any other season. The rainfall shows an average of 7·144 inches, while rain falls upon 48·49 days out of the three months. The rainfall is less than during any season but spring, though the number of rainy days is only exceeded in autumn. In this quarter of the year the number of days on which south-west winds blow is at its greatest; west winds also reach their maxima at Aysgarth, Cramlington, Scarborough, and Alnwick; north-east winds, however, are infrequent, and reach their minimum at all stations except Halifax. The strength of the wind is at its greatest (average for winter 1·4, for the year 1·3), and varies between 0·81 at Halifax and 2·55 at Scarborough.

Summary.—Winter in Northumberland, Durham and Yorkshire is cold, compared with the British Isles as a whole; it is windy and rainy, nevertheless some places show by their small proportion of cloud that there is for the season of the year at those places a considerable amount of sunshine. The snow falls very thick, and in the more mountainous parts of the district it drifts, often rendering the roads completely impassable. The sensation is given that the temperature is lower than it really is by the fact that there is a considerable degree of humidity, that the wind blows with more force than at any other period of the year, and in certain districts that the prevalent south-west and west winds have come not only over a large tract of land, but also immediately from snow-laden moors, under all of which circumstances the climate becomes biting cold.

In the following table are given at a glance some of the principal of the foregoing facts.

TABLE SHOWING THE CHIEF CHARACTERISTICS OF THE CLIMATE OF NORTHUMBERLAND, DURHAM AND YORKSHIRE, AS DEDUCED FROM THE OBSERVATIONS AT THE FOLLOWING STATIONS.

PLACE.	SEASON.	MEAN TEMP.	RANGE.	HUMIDITY.	CLOUD.	DAYS OF RAIN.	RAIN-FALL.
							Inches.
ALNWICK (Northumber- land)	Spring	43.13	16.24	81.63	6.67	40.0	6.98
	Summer	54.97	16.27	81.73	6.73	47.6	9.85
	Autumn	45.97	12.46	87.63	6.30	58.3	10.36
	Winter	37.13	10.17	86.80	5.93	44.6	7.88
CRAMLINGTON (Northumber- land)	Spring	42.25	14.38	83.68	6.67	47.9	6.03
	Summer	55.61	15.81	83.57	6.89	42.1	7.41
	Autumn	46.55	13.00	88.09	6.43	51.2	7.88
	Winter	37.41	10.93	88.53	6.35	46.8	5.108
USHAW (Durham)	Spring	42.47	13.30	83.33	7.19	49.0	7.770
	Summer	55.96	14.94	75.98	6.89	36.4	7.206
	Autumn	46.48	11.12	87.12	6.84	46.2	8.584
	Winter	36.10	9.70	90.87	6.59	47.2	4.550
ROXTON (Yorkshire, N.)	Spring	42.96	16.73	86.58	6.47	48.7	5.88
	Summer	56.38	14.73	81.85	6.35	42.7	6.54
	Autumn	46.79	12.87	88.85	6.70	51.7	6.87
	Winter	37.23	10.29	90.83	6.16	48.4	5.34
AYSGARTH (Yorkshire, N.)	Spring	42.51	14.14	79.53	6.75	46.2	7.440
	Summer	55.26	15.57	79.69	6.59	45.0	10.320
	Autumn	45.83	11.31	86.22	6.93	59.2	11.640
	Winter	36.38	8.48	87.26	7.05	54.8	13.076
SCARBOROUGH (Yorkshire, N.)	Spring	44.47	10.83	83.13	6.00	47.1	6.972
	Summer	57.33	11.97	83.67	6.27	43.5	6.229
	Autumn	48.33	9.34	86.50	6.13	53.1	8.294
	Winter	38.80	7.77	89.17	6.37	50.8	6.034
BRADFORD (Yorkshire, W.)	Spring	44.40	12.57	77.80	6.83	47.9	6.63
	Summer	57.33	13.73	73.20	6.67	50.0	7.92
	Autumn	48.17	9.94	81.10	7.17	55.0	9.58
	Winter	38.93	8.37	85.70	7.80	48.7	7.06
HALIFAX (Yorkshire, W.)	Spring	43.20	15.60	79.47	6.77	41.3	7.85
	Summer	56.00	18.17	77.90	6.93	42.4	8.45
	Autumn	46.70	12.00	85.77	6.93	53.1	11.60
	Winter	36.33	8.93	88.97	7.58	46.8	9.32
HULL (Yorkshire, E.)	Spring	44.83	15.97	78.97	6.11	47.6	5.91
	Summer	57.73	18.03	78.23	6.37	43.7	7.08
	Autumn	48.17	13.30	82.23	5.90	51.8	8.39
	Winter	37.93	10.67	85.70	6.20	48.3	5.93

Barometric Pressure.—Consideration of the barometric pressure has been reserved to the last in this Report, and separated from the other meteorological data, since less reliance can be placed on it as indicating the climate of various resorts than upon temperature, cloud, rainfall, etc. Nevertheless some notice is necessary. According to the *Meteorological Atlas of the British Isles*, Northumberland, Durham and Yorkshire lie between the following isobars:—

January	29·82 and 29·88
February	29·84 „ 29·90
March	29·82 „ 29·86
April	29·90 „ 29·93
May	29·94 „ 29·96
June	29·94 „ 29·96
July	29·88 „ 29·92
August	29·88 „ 29·92
September	29·84 „ 29·90
October	29·80 „ 29·86
November	29·82 „ 29·88
December	29·82 „ 29·92
Whole year	29·86 „ 29·90

Thus in spring, as we have already defined it, the mean pressure would lie between 29·89 and 29·92; in summer between 29·99 and 29·93; in autumn between 29·82 and 29·88; and in winter between 29·83 and 29·88. These figures are corrected for 32 F. and the sea-level. From the eight stations in Northumberland, Durham and Yorkshire, used in this inquiry, at which barometric statistics are available—none are taken at Ushaw—the figures appear to be somewhat different and lower in every case than those derived from the *Meteorological Atlas of the British Isles*. Thus in spring the mean of the pressures at those places is 29·708; in summer 29·703; in autumn 29·676, and in winter 29·708, while for the whole year it is 29·699. Here however no corrections are made, and the low pressures of Halifax and Bradford on high ground stand side by side with those of Scarborough and Hull close to the sea-level. From the above figures it will be seen that pressure is lowest in autumn; this fact is to be associated with the amount of rain, for as has already been said the rainfall in autumn is at its highest point. The high pressure in spring is to be associated with the prevalence of north-east and east winds. Of all the stations the barometer is lowest at Halifax (530 ft.) and highest at Rounton (242 feet), where the pressures are for the year 29·388 and 29·922 respectively. Hull and Scarborough come close together in the first half of the series, while Aysgarth though 658 feet above the sea-level is not far behind. This too in spite of the fact that it has the greatest number of rainy days and the largest rainfall of any of the stations.

PART II

SPECIAL DESCRIPTION OF THE INDIVIDUAL HEALTH RESORTS.

WE have now come to the special portion of our subject, and shall deal with the various resorts according to their geographical position, beginning with those in Northumberland.

RESORTS IN NORTHUMBERLAND.

Berwick-upon-Tweed, with Tweedmouth and Spittal.—

These three places lie on the north and south sides of the mouth of the Tweed. Tweedmouth and Spittal being on the south. The latter two towns, which are the chief part of the district to which visitors resort, are continuous with one another and lie on a sandy level with small hills around them, the houses themselves, which are moderately well built, being in a hollow. The sea-bathing is considered to be very good at Tweedmouth and Spittal, and people cross over from Berwick to enjoy it.

Berwick itself stretches up a gentle acclivity (200–300 feet), forming the northern bank of the Tweed and looks towards the south. The streets are narrow, straggling and irregular. The quay forms a long promenade widely exposed to the north and north-east winds which here blow with great force. There is moreover a deficiency of wood in the neighbourhood.

Taking all things into consideration the writer is of opinion that the attractions of Berwick, Tweedmouth and Spittal are somewhat over-estimated, and that they are of more interest from a historical than from a therapeutic point of view.

Alnmouth and Alnwick.—As its name implies, Alnmouth is situated at the mouth of the Alne, and is four miles south-east of Alnwick. There are good sands in the neighbourhood. Judged by the statistics from Alnwick, the temperature is slightly below the average for Northumberland, Durham and Yorkshire in all four seasons of the year, the greatest difference being in summer and autumn. The amount of cloud is below the average, humidity

and rainfall above the average, but the number of rainy days is about the average. North, north-east and east winds are below the average, south-east, south, west and north-west are above, while calm days are more frequently found than at Aysgarth, Cramlington, Rounton, or Scarborough.

Bamburgh.—Bamburgh is situated on the sea-coast, and is five miles east by north of Belford. The soils in the neighbourhood are various. The uplands are igneous rocks, in other places limestone and sandstone are abundant, and cause the water which comes through them to be hard. The sewage is conveyed by trapped sinks into socketed pipes and thence to waste land half a mile south-east of the village, where it is absorbed by a sandy soil above high-water mark. The water supply is by shallow wells in the village, which are remotely derived from the uplands passing through limestone. There is an abundant supply, and the quality is said to be good. There is very little wood in the vicinity, most of the land being arable or pasture. The village is not immediately protected from any winds, and is much exposed to north and north-east winds,

Cramlington.—Cramlington is only here noticed, inasmuch as it is one of the meteorological stations used in this inquiry. It is $8\frac{3}{4}$ miles north-north-east of Newcastle-upon-Tyne. The station is 255 feet above the sea-level, and in spring is the coldest of all the nine stations. West, south-west and north-east winds are much above the average here, but south and south-west are below the average. The rainfall it will be noticed from the tables given is small. (See pp. 256 and 278.)

Along the sea-coast are many small villages not worthy of mention. It may however be remarked that the coast of Northumberland is for the most part sand, and therefore suitable for children, while on warm days at many places the sea-bathing is excellent.

Tynemouth, North Shields, Cullercoats and Whitley.—Tynemouth, with North Shields, Cullercoats and Whitley, which together form one borough, is on the northern bank of the river Tyne, and eight miles east-north-east of Newcastle. Tynemouth is situated about a mile eastwards of the market-place of North Shields. The houses are fairly well built, and during the summer the town is much resorted to by visitors for sea-bathing. The Prior's

Haven, being sheltered by an amphitheatre of rocks, separated from each other at the entrance by a distance of two hundred yards, forms a fine bay. Percy's Bay at the north side of the Priory, formed in the early years of the century by a severe storm which carried in an immense quantity of sand, is also favourable for bathing. Cullercoats is one and a half miles north-north-west of Tynemouth, and is also a sea-bathing resort. Whitley is two and a half miles north by east of North Shields, and is on the whole well built. Coal, magnesian limestone, and iron ore are found in considerable quantities in the neighbourhood, and mining affords employment to the greater number of the inhabitants. The prevailing wind from March to May is easterly, for the rest of the year westerly.

RESORTS IN DURHAM.

South Shields, in the county of Durham and on the south side of the river Tyne, has only of late years become a resort for visitors. It is built on a sandy soil beneath which is clay, and below that again magnesian limestone. In the lower parts of the town by the river most of the natural clay bottom has been covered with ballast hills of great size and height, on which the houses are built. These ballast hills consist of gravel and sand. In the higher parts of the town—in some places over one hundred feet above the sea-level—the dolomite rock comes to the surface. The death-rate for the town for the decennium 1881-90 was 20·8 per 1,000 and the zymotic rate 2·4. The death-rate from pulmonary diseases is high; for the ten years above mentioned it was 5·5 per 1,000, while in 1890, owing to complications following on the epidemic of influenza in that year, it rose to 7 per 1,000. The high death-rate from these causes is partly occasioned by the severity of winter and spring when cold north-east winds are very prevalent, partly from the number of chemical works in the neighbourhood, and also by the conditions of life of the people, a large number of whom are either employed in the chemical works or are miners. Many of the houses, also, in the old part of the town are very damp. Diarrhœa causes a high death-rate, 1·2 per 1,000, and this also depends partly upon the insanitary condition of the old town, and probably also upon the fact that infants are in numerous instances exclusively fed on condensed milk. The water

supply of South Shields in common with that of Sunderland is obtained from deep wells in the magnesian limestone. It is very free from organic impurities, but is extremely hard. All the sewage of the town drains into the Tyne, and is carried well out to sea by a large body of water constantly coming down the river. The sewers are well laid, and generally have a good fall. An attempt has been made to purify the sewage before passing it into the river. At present however no nuisance arises from this method of liquid sewage disposal. The dry refuse and the contents of the privy receptacles are mostly sent or given away to farmers in the neighbourhood, but at certain times they cannot take the whole, and the Corporation has recently bought some land on the river-side on which to build a wharf whence it can be shipped to sea. As regards climate it is cool in summer, and usually very fine and bracing, but during the winter and early spring variable and rigorous, the north-east winds being very searching.

Sunderland, with **Bishop Wearmouth** and **Monk Wearmouth**, which form its northern and south-western portions respectively, is an important commercial centre, but of little interest from the point of view of this inquiry. It is to **Roker**, which immediately adjoins Sunderland, that visitors chiefly go. This is a place of quite recent date, for no mention of it is made in the *Parliamentary Gazetteer* of fifty years ago. As at most of the health resorts on this coast, sea-bathing in summer is here very greatly indulged in.

Seaham is pleasantly situated on the sea-coast at the conflux of a rivulet which rises and flows eastward from Wardenlaw. There is an excellent harbour which really constitutes the resort for visitors. Some parts of the town are badly built, overcrowded, and inhabited by very poor people. The system of drainage is by earthenware pipes which communicate with iron mains that are carried out to sea. In the poorer portions of the town privies prevail, while on the outskirts the earthenware house-drains run into brooks communicating with the sea. The water is supplied by the Sunderland and South Shields Water Company, and is very hard, being pumped up from the magnesian limestone. Typhoid fever, diphtheria and diarrhoea are common in summer; phthisis and lung affections generally, at other times of the year.

Seaton Carew is much frequented for its sea-bathing. The

beach and sands are smooth and level for an extent of five miles. The village has been growing during the present century, and its sands attracted visitors quite early, so that it underwent very considerable improvement. To the north of the village are two lighthouses indicating the entrance to the Tees. No information concerning drainage or water supply has been obtained.

Ushaw Moor is only noteworthy on account of its being one of the stations whence meteorological data have been taken for the purpose of this inquiry. It is about four miles to the west of the city of Durham, and the statistics which were taken at the Roman Catholic College there, at a height of 600 feet above the sea-level, show that the average temperature in all four seasons of the year is below the average for Northumberland, Durham and Yorkshire by about one degree. The amount of cloud (6·878) is above the general average (6·6), but below that of both Bradford (7·118) and Halifax (7·052). Humidity is also above the general average, but not to any great extent. Rainfall, and the number of days on which rain falls, are both below the general average, being in the former case 28·110 inches, while the average for the three counties is 30·975 inches, and in the latter case 178·8 days, while the average for the counties is 191·68 days. No information concerning winds and their prevalence is available.

Darlington, Barnard Castle, Richmond, and the surrounding country, which includes portions both of Durham, in which county the two former towns are situated, and Yorkshire in which the last-named is situated, form a part of the high ground that lies towards the western side of the division of the kingdom now under consideration. They are all three small towns, Darlington, however, being by far the largest. They contrast very favourably as regards general cleanliness of appearance with many of the larger towns that lie close to them in the two counties. Barnard Castle and Richmond are quite rural in aspect, but Darlington, though busy, is not so intimately connected with the iron-working industries as for example Middlesborough, and therefore presents a cleaner aspect. It is situated on rising ground in a district largely given over to grazing, on the western bank of the river Skerne, three miles above its junction with the Tees. Barnard Castle is situated on the south side of an eminence rising abruptly from the northern bank of the Tees. The environs are well wooded, and in

the valley of the Tees, of which the district forms a part, it is singularly beautiful. All around there is much high land which in Yorkshire forms the "moors." Richmond, the principal town in the Yorkshire moorland—at all events for the purpose of our inquiry—is pleasantly situated on an eminence on the northern bank of the river Swale. It is the chief centre from which shooting parties start for the moors. The district around these three towns is considerably exposed over the major portion of its extent, though in the neighbourhood of the rivers the land forms deep valleys, while the Tees flows at the bottom of a ravine. The result of this natural formation is that fogs, as has already been said, are very common at certain times of the year, particularly in spring and autumn. Occasionally they last far on into summer, as at Barnard Castle, where they were very severe in July and August 1892. In winter the snow drifts along the roads owing to the force with which the wind blows, and often renders them impassable. The dales are, as might be expected, moist and damp, green moss and fungi being abundant. The climate is temperate, and it is rarely intensely hot except on those days on which with a cloudless sky there is absence of wind, and this latter is uncommon on the moors. The amount of moisture in the air however accounts for the fact that the weather is either stifflingly hot in the dales on a summer's day, or else quite chilly and raw. Nevertheless once the higher ground has been reached the stagnation of the air disappears. The town of Darlington is supplied with water which has come from the hills, and although it is very soft it is strongly impregnated with vegetable impurities, so that even a small hand-basinal looks quite brown, while a bath has by no means an inviting appearance. Except in the height of summer the supply is abundant. The inhabitants of Richmond are abundantly supplied with water from Aislabeck spring, which is conveyed through the town by pipes. Barnard Castle itself is well sheltered, and in the immediate neighbourhood there is abundance of wood, notably oak, elm, and ash; the worst winds here are the northerly ones, which blow over the moors, and are very prevalent in November, December and January. In the early months of the year there is a great abundance of rain.

RESORTS IN YORKSHIRE.

Redcar, six miles north by east of Guisborough, is a small low-lying town, being but little raised from the sea-shore. It has only been frequented for the last fifty or sixty years, and before that time the inhabitants were only fishermen. The chief characteristic of the place is the magnificent stretch of sand which reaches for a distance of several miles: it is possible to walk on firm hard sand to Saltburn six miles lower down the coast. This renders sea-bathing very agreeable, while the sands make it a place particularly suitable for children. Out at sea the coast of Redcar is extremely rocky and dangerous. The Redcar Urban District is supplied with water from springs on the hills collected into a reservoir. It is well sewered; the sewers are ventilated by means of openings at the street level and shafts carried up the sides of houses, etc.; they are periodically flushed, and the sewage is carried out to sea. Diphtheria is comparatively rare, and the chief deaths are from pulmonary causes.

Saltburn.—In the *Parliamentary Gazetteer* of fifty years ago this town is not even mentioned, and in fact the old part of the town consists of a single short row of fishermen's cottages on the sea-shore to the south of the town itself. Saltburn is not picturesque as a town, for the houses are mainly built in terraces and are small, but it offers the advantage of practically having no old and therefore insanitary part. It is a growing town, and the drainage is very good. The cliff on which the town is built is about 150 feet high and looks towards the north: at its eastern end it rises into a promontory 360 feet in height called "Huntcliff." From this promontory a ridge of far higher elevation rises in a direction nearly due south a long way into the interior; this ridge, varying from 400 to 600 feet in height, finally loses itself in the Cleveland Hills, which attain to heights of over 1,000 feet. Thus Saltburn is well screened on its eastern side by a barrier of hills many miles long, and several hundred feet higher than the town itself. The prevailing winds are westerly. In winter the south and south-west winds are cold, inasmuch as they have travelled over the snow-laden moors; but for the reason that they have come over the sea and that their force is mitigated by the barrier of high

land above-mentioned the east winds in winter are warmer than any others. The force of the wind is greatest in the month of October. The amount of rainfall is small and there is a large amount of sunshine. But one of the greatest advantages of Saltburn consists in the fact (to which allusion has already been made when speaking of vegetation in the early pages of this Report) that two absolutely different climates are obtainable by simply crossing the road. Bracing on the cliff itself, in the "Glen" it is invariably moist, mild, and sheltered from wind, the climate being quite comparable with that of Devonshire or Cornwall. Part of the glen is laid out in gardens, and here the sunshine may be enjoyed with only the softest breeze, even though on the cliff the force of the wind may be considerable. It must however be remembered that the town is essentially quiet. There have lately been erected baths, with swimming, sitz, douche, needle, spray, electric, brine, and vapour baths. Massage can be arranged for if necessary. For the swimming bath the water is pumped up from the sea; for the brine baths the brine is conveyed by rail in specially constructed tanks from the brine wells at Middlesborough. The water supply of Saltburn is exceptionally good. It is stored in a reservoir with a superficial area of 44 acres at Lockwood near Moorsholm, 627 feet above sea-level, and about seven miles distant from Saltburn. Thence the water is conveyed by pipes the whole way to the town, and the supply is continuous and never fails.

Whitby is situated partly on the eastern and partly on the western bank of the river Esk; the latter forms the larger and wealthier portion of the town. The streets are exceedingly narrow, and the old houses are built as close to the river and sea as possible; on the eastern side they stand almost upon the sands. Behind these old houses the ground rises rapidly on each side of the river; on the eastern side the ridge is so steep that it appears to have almost stopped all building in an easterly direction, but on the west it is more gradual, and accordingly streets running from east to west pass into the country behind. In 1540 Whitby was only a fair-sized fishing town, but after the discovery of the alum-mines at Guisborough it rapidly increased in importance, so that in 1776 it owned 251 ships of 80 tons burden. From that time however the prosperity has decreased so that at the present time Whitby is a quaint old-fashioned town possessed

of attractions mainly for the artist and the antiquarian, though it still is important from the point of view of fisheries. The water supply is excellent, and is brought a distance of 14 miles from the moors; the supply is ample. The town has lately been receiving a new system of drainage. All the drainage is carried into the harbour. The town is built upon an important portion of the Lias: in some parts of the town the soil is gravel and sand. The general health of the population is satisfactory, the principal cause of death being natural decay.

Robin Hood's Bay is the name of a bay which lies about half-way along the coast between Whitby and Scarborough: it is also the name of a small village that exists in the bay. Few visitors make this their headquarters on account of the scanty accommodation and the extreme quiet of the place, but the scenery along the coast is some of the finest from the Tweed to the Humber, and the cliffs rise to a considerable height. Inland there are the Cleveland Hills.

Scarborough.—The town is picturesquely situated on a bold and rocky slope that skirts a fine bay: it thus forms half of an amphitheatre of which the lowest tiers are built on the Foreshore. To this must be added the north side of the town which lies beyond the Castle Hill. The north side has a separate pier, and in fact hardly seems to form a portion of Scarborough proper. It is well-built but looks dreary, and the sands form its chief attraction. In the ensuing description the south side, or "Scarborough" as the visitor knows it, is alone considered. The town is evidently prosperous, and the resident population numbers over 35,000. This number is annually increased by over 50 per cent. by the influx of visitors, and of these the large majority come in July and August. They however are mainly pleasure-seekers, are in good or tolerably good health, and need only bracing up after a season of gaiety in the case of the more aristocratic, and of confinement in cities and towns in the case of the lower middle classes. For both these classes amusement of all descriptions is provided. Scarborough is fairly protected from winds blowing from the south and north-west, but the strength of the wind is great (2·28). South-west and west winds are absolutely the most common, and blow on an average 153 days out of the year. North and north-east winds account for 80 days.

South-west and west winds increase in frequency through the four seasons, being least frequent in spring, most frequent in winter. North and north-east winds show the exact opposite characteristic and are commonest in spring, least common in winter. The mean temperature of Scarborough in spring is $44^{\circ}\cdot47$; in summer $57^{\circ}\cdot33$; in autumn $48^{\circ}\cdot33$; and in winter $38^{\circ}\cdot80$. For other points in the climatology the reader is referred to the table on page 281. The climate of Scarborough in summer is warm though bracing in the day-time, but at night outdoor lounging without extra wraps cannot long be indulged in. Nevertheless it is not so cold as might be supposed. As far as the sanitary arrangements of Scarborough are concerned they are in some respects excellent; thus there is in the town a Ransome's disinfecting stove which in cases of infectious disease is used extensively, and also there is a system of granting sanitary certificates after inspection to the owners of lodging-houses. But the entrance to the harbour is very narrow, and the discharging sewers (though they are well ventilated and periodically flushed) are not carried out sufficiently far. In the older parts of the town the courts and alleys, of which there are numbers, cannot in hot weather be kept devoid of objectionable odour. The streets as a rule run east and west, the houses consequently face north and south. The water supply is from springs at the foot of the cliffs in Cayton Bay and from a well at Cayton, both $3\frac{3}{4}$ miles south of Scarborough, and by reservoirs to which the water is raised by pumping. The mouth of the well is 159·6 feet above the sea-level and the shaft is sunk 137 feet below to the Oxford clay, through the limestones and calcareous sandstones of the coralline series of the middle oolite and thence through the lower calcareous grit. On the Foreshore is the Royal Northern Sea-bathing Infirmary, which is open from May till the middle of December, and receives patients from all parts of the county. Reference will be made to it again when the prevalence of disease and the therapeutic uses of the climate are under consideration.

Filey is a small town, seven miles south-east of Scarborough; it stands on a high elevation and is well drained; the air is pure and fresh. There is a level stretch of six miles of sand which renders the place very suitable for children. Nervous, dyspeptic, and all kinds of debilitated persons do well here, but for chest

affections, rheumatism, etc., it is too cold. It is somewhat subject to sea-fogs.

Bridlington.—In the case of this town it is the Quay which forms the seaside resort, Bridlington itself being situated half-a-mile further inland. Bridlington Quay is situated in a fine bay, faces the south-east, and possesses a good harbour with a great number of pleasure sailing-boats. There is bathing to be had, but it is not so good as at some other places in Yorkshire. The drainage is fairly good: it is by the water-carriage system. The water supply of the town is obtained from borings which go deep down into the chalk: thence it is pumped up and stored in a reservoir. The water-works are on high ground quite away from the town. The water is hard. The wind is at times very strong even though it come from the south-west, and is thus to some extent warded off by the eastern moorland. On the north Bridlington Quay is protected to some degree by the high land which terminates in Flamborough Head.

Hornsea is a small town which lies very flat, but the monotony is relieved by a fair amount of vegetation. The soil is chiefly sand and gravel. Behind the town lies an expanse of fresh water, called the "Mere," which is used for boating purposes. The system of drainage is by sewers which discharge into the sea, an intercepting tank for collecting the more solid excreta existing near the outfall. The sewers are flushed by the surface and house slop-water, and also by a current turned on from the main water supply of the town from time to time. In addition there are short periodical collections from middens of the dry kind. The water is derived from a deep well bored into the chalk that is found so extensively in the district. It is very hard, but a large proportion of the hardness is "temporary." The distribution is constant. It is brackish in taste. The vast majority of visitors come from Hull and its neighbourhood, excursions being run into the town very frequently throughout the summer.

Withernsea is a most uninteresting flat sandy place, and its only advantage is the presence of the sea. Though excursionists frequently run in from Hull, the town has evidently not set itself out to attract visitors, while its surroundings are not such as to attract by themselves. The hotel has recently been bought for conversion into a convalescent home.

Concerning York, Hull, and many other towns in Yorkshire, no notice can be given; it is only necessary generally to say that inland there is a large amount of beautiful country, though the large manufacturing towns are not the resort of visitors. Around Pontefract, Beverley, and even Sheffield, the country is delightful, while in the West Riding among the hills it is unique in England. Speaking broadly the air is bracing, and the water supply good, but the drainage is not satisfactory as middens are extremely common, and through them the water supply of any individual village may easily become contaminated. At Harrogate in particular, and at many other places in Yorkshire, mineral springs exist. Those of Harrogate have already been dealt with in the previous volume of this work. Of the remainder, it is sufficient to say that for the most part they are either sulphurous, chalybeate, or saline aperient in character.

Prevalence of Diseases in the District.—In this connection a difficulty at once presents itself. Diseases which are *absolutely* uncommon in England as a whole may be in that particular district *relatively* common, although the *absolute* number of cases occurring may be but a small fraction of the annual number of cases seen by a medical man. Rheumatism and bronchitis are so extremely prevalent in all parts of England that there is no difficulty in predicting that they will be prevalent in Northumberland, Durham and Yorkshire. But when information is given that bronchitis is “very common,” and typhoid fever “uncommon,” that really gives no information concerning the prevalence of either of those two diseases in the district *as compared with other districts*, which is really the essential point. If, for example, a medical man sees two hundred cases of rheumatism and bronchitis in the year, and twenty of enteric fever, he is very apt to say that rheumatism and bronchitis are “very common,” and enteric fever is “uncommon.” This no doubt is true, but the prevalence of enteric fever in that particular man’s practice is relatively greater than the prevalence of rheumatism and bronchitis. Nor are death-returns satisfactory, for speaking generally the greater number of cases of all three diseases recover, and therefore death-returns give no indication of the prevalence of the disease, but only in the case of enteric

fever for example, an indication of its severity. In the present paragraph therefore the incidence of rarer diseases must only be regarded as generally true, though the greatest possible care has been taken to arrive at the facts. For this purpose the answers derived from the correspondents from the various resorts concerning any disease have been given numerical values and an average has been deduced. Thus if a disease has been said to be "absent" it has been put down as 0: if "very uncommon," as 1: "uncommon," as 2; "below the average," as 3; "average," as 4; "above the average," as 5; "common," as 6: and "very common," as 7. The writer is fully aware that this method does not do away with the difficulty entirely, but at all events it eliminates the personal equations of the individual correspondents. With this explanation it may be stated that rheumatism, pleurisy, and pneumonia are "above the average," while bronchitis is "common," viz. more above the average than the three preceding diseases. These four diseases are very prevalent during the late winter and spring months when north, north-east, and east winds blow with great regularity and considerable force over the whole district. At Saltburn and Hornsea however rheumatism seems to be less common than at other places, though on account of the brine baths at Saltburn there is a great influx of rheumatic patients. With regard to bronchitis and catarrh, they appear to be without exception, more frequent in the district than elsewhere in England, and this is only what would be expected. Chronic renal and acute renal disease are both noted as "below the average," acute renal disease being much below the average. From the frequency however with which "cerebral hæmorrhage" is noted as the cause of death, there is a probability that "below the average" does not mean anything more than that numerically the number is less than other diseases. When one remembers the difficulty there is in diagnosing the many cases of renal disease, particularly of the chronic type, it will be juster to regard the incidence of renal diseases understated rather than overstated. Calculus and gravel are both very uncommon. Anæmia of girls, particularly though not by any means exclusively affecting the poorer classes, is a common condition; it is more generally seen in factory hands and domestic servants. It appears to be common at Scarborough, Hornsea, Seaham, and Bamburgh, among seaside resorts, but

not uncommon at Berwick, Tynemouth, or Bridlington. It is of the usual type, accompanied by constipation. Pulmonary tuberculosis is another of the diseases in which it is particularly desirable to arrive at a definite opinion, but in which the difficulty already noted comes in. At Bamburgh, Seaham, and Saltburn it appears to be common, as also at Scarborough among the poorer residents. At Tynemouth and Hornsea it is given as uncommon, while at Bridlington it is noted as about the average. It would be reasonable to expect that the disease should be less prevalent from the coldness and dryness of the climate and from the small number of phthisical patients who go to these north-eastern parts for their health. But, on the other hand, bronchitis and catarrh, and the effects of occupation are potent factors in the causation of the disease. Consequently, speaking generally, we must conclude that pulmonary tuberculosis is more common than usual through the district, though at some of the seaside resorts it is uncommon. One thing however is certain, and it is that *the variety of phthisis called fibroid phthisis or fibroid pneumonia is more common in the district than anywhere in the United Kingdom with perhaps the exception of certain parts of South Wales.* The occupation of so many of the inhabitants in mining, knife-grinding, etc., where large quantities of dust are inhaled is particularly conducive to the occurrence of this form of the disease. Another point which also comes out very clearly is the rarity of hæmoptysis; in this respect the remark of Mr. Wetwan of Bridlington is worthy of attention. He says with reference to phthisis, "both classes of disease (viz. fibroid and pneumonic) are in my experience more liable to hæmoptysis when exposed to sea-air." Asthma is noted as having caused a considerable number of deaths at various places. Scrofula and tuberculous diseases of joints and glands appear to be about the average, tuberculous enlargements of the glands being the most common affection. Rheumatism is principally of the chronic variety, though there is a large proportion of acute cases. These latter have a very marked tendency to affect the heart, and speaking generally heart disease is one of the commonest causes of death. The effect of rheumatism is no doubt powerfully assisted by the laborious nature of the work in which so large a number of the population—particularly in the neighbourhood of

the collieries—is engaged. Rheumatoid arthritis is uncommon, but it must be remembered that this—apart from chronic rheumatism—is by no means a common disease. There is no way of determining whether the number of cases occurring in Northumberland, Yorkshire and Durham is abnormally large. Neuralgia, affecting particularly the fifth nerve, appears to be more common and more obstinate than elsewhere. Skin diseases are rare excepting eczema, and that is not common. Visitors to seaside resorts not infrequently suffer from it on first commencing their stay, but usually it is amenable to treatment. Like neuralgia however, in residents and in those subject to it, it is very intractable. Amongst endemic diseases malaria is completely absent, and is never seen but when, as in the case of persons who have lived in India, it has been contracted elsewhere. With regard to typhoid fever there is difficulty in speaking, but in all the towns from which reports have been sent it has been noted as occurring “sporadically,” “through the year in a small degree,” etc., with the exceptions of Bamburgh where the note is “no case for years.” At Scarborough hardly a season passes but what some deaths are noted from this disease, but in this connection it must be remembered that for the supply of the large number of inhabitants and visitors to Scarborough, food—particularly milk and butter—must be brought thither from all the country round, so that the chances of cases occurring are increased. Diarrhoea is mainly confined to the two extremes of life, and particularly to children under two years of age. It is common during the summer at Tynemouth, but rare at Scarborough and Hornsea. Scarlet fever occurs sporadically or in very small epidemics. Diphtheria also occurs sporadically, though at times there are local, and occasionally (as for example at Bridlington a few years back) very fatal epidemics. Nevertheless it occurs more or less in every place, and where the midden system still obtains largely, as in most of the smaller villages, and even in York and Scarborough, the disease is not likely to be completely prevented. Endemic sore throat is generally but little seen over the district, though at Tynemouth and Seaham Harbour it is very prevalent during the spring months. Regarding zymotic diseases as a whole, there is very great difficulty in determining the prevalence in any particular place, as the tendency in seaside

resorts, where especially it is important for the town to show a clean bill of health, is to explain all cases as having been imported, and the small villages around are generally incriminated.

One thing that strikes the stranger, and particularly one accustomed to the patients seen in London hospitals, is *the marked absence of rickets*. It may almost be said to be unknown, and on several occasions the writer was asked what was meant by the term. Diarrhœa in children occurs from bad feeding, etc., as it does elsewhere, but though starch is a very general article of diet for children under one year, bowed legs and enlarged wrists are seen with the utmost rarity. Whether the amount of open air they receive, or whether the chalky nature of the water in many parts of Yorkshire explains this peculiar exemption, must be left an open question. In connection with the prevalence of disease it may be of interest to give some particulars derived from the Report of the Royal Northern Sea-bathing Infirmary at Scarborough. During a recent year there were admitted 587 patients, which were divided in the following way as regards their homes:—

Patients from the West Riding	374
„ „ North and East Ridings	144
„ from other parts.	69
	<hr/> 587

Or considered in greater detail:—

Leeds and Bradford district	114
Sheffield district	133
York district	118
Halifax and Wakefield district	49
Knaresborough, Thirsk and Ripon district	26
Hull and Selby district	34
Doncaster district	45
Leicester, Derby and Nottingham district	40
Other localities	28
	<hr/> 587

The important point to note is the large proportion that came from the manufacturing districts, and particularly the large number from the West Riding, the inhabitants of which evidently require more of the bracing air than those of other parts. The principal diseases from which they suffered were:—

Debility	128
Debility after influenza	93
Anæmia	47
Phthisis	50
Bronchitis	37
Rheumatism	31

—while there was the comparatively large number of 10 who were admitted and stayed for a month for neuralgia. There were 23 who were admitted for “scrofula” and “spinal disease.”

Old age, according to information received from medical men living in the district, does not begin till seventy-five or thereabouts. In Cullercoats, which has a population of about 1,350, there were at the time of writing 19 persons living whose age averaged 79·78 years. At Tynemouth in the previous year out of 155 deaths, 67·4 per cent. were over 50 years of age; 15 persons were over 60 years, 8 over 70, and 4 over 80. At Scarborough, out of 153 deaths in private practice, 48 were of persons of 70 years and upwards, and of these 33 were from 70 to 80 inclusive, and 12 from 81 to 85 inclusive, while the remaining three were aged 87 years, 91 years, and 94 years respectively. Very similar reports also come from Hornsea. Nevertheless this longevity does not show itself in the towns. Inland, at Leeds, Sheffield, Bradford, etc. the duration of life is much less, and a much smaller proportion of the inhabitants even reaches 60. Special trades and occupations also affect the duration of life very considerably, miners and iron-workers in particular suffering very severely after middle life; factory hands, largely consisting of women, also show the same mortality soon after middle life, not only because their work is injurious, but also because the rate of births in these densely populated parts is high, and the women re-commence their work very soon after confinement.

The chief causes of death in order of frequency are bronchitis, phthisis, cardiac disease, and pneumonia, while apoplexy accounts for about 4 per cent. of deaths. At Scarborough cerebral hæmorrhage is noted as being “by far the commonest cause of death amongst all classes.” Phthisis is not uncommon amongst the poor. Amongst children diarrhœa is the commonest cause, and particularly affects infants under one year. Of zymotic diseases whooping-cough is also accountable for a considerable proportion of deaths amongst young children. Typhoid fever is always noted as causing a certain number, as also diphtheria, the latter however being less frequently noted.

Therapeutic Uses of the Climate.—In the course of the foregoing remarks this part of our subject will have largely declared itself. The climate is eminently bracing, but it is too cold, and the wind is too strong for many varieties of disease. Speaking

generally, no invalid should be sent to this coast, since to derive benefit individuals must be physically capable of combating the climatic conditions to which they will inevitably be exposed. No patient with disease of the respiratory organs should be sent thither, though perhaps an exception might be made in the case of incipient phthisis, since many medical men in the district say that such cases derive benefit. Thus at the Scarborough Seabathing Infirmary in one year, 49 out of 57 phthysical patients gained weight, to the amount on an average of 5 lbs., but on the other hand in another year, 79 phthysical patients were admitted, and of these 21 lost weight, and 6 neither gained nor lost. Gain in weight however does not by any means necessarily indicate that the disease is arrested or even improved, so that the figures must not be taken to prove too much. *Where early phthisis is discovered in a patient who otherwise is in good health there is reason to hope that the Yorkshire coast might be beneficial, but it must only be tried in summer or early autumn, and by preference Saltburn should be chosen, inasmuch as a more southern climate is immediately obtainable in the Glen if the exposed ground prove too cold.* Hæmoptysis is a contra-indication to sending a consumptive patient to this coast, while advanced disease would speedily end fatally. Renal disease does not do well; the climate though dry is too cold, and the skin has not its activity sufficiently called into action. Rheumatism does not do well, except at Saltburn and Scarborough, where patients undergo treatment with brine-baths, and there the benefit is in no way derived from the climate but rather from the hot water. Eczema, as at other sea-coast resorts, is very apt to become aggravated, not only by the saltiness of the air but also from the keenness and strength of the wind. Anæmia, according to the matron of one of the hospitals, does not derive much benefit, but the disease is so chronic that only a protracted stay could be likely to do good. *The classes of case for which these north-eastern parts are suitable, and here they are of the greatest value, are over-worked persons, both mentally and physically, who require a bracing treatment, particularly if they have lived in crowded cities or towns and lead usually a sedentary life. To these must be added children, for whom the sands and sea-bathing are especially valuable.* There is no difficulty in finding a bracing part, for if the coast be too little

bracing there are the moors; nevertheless only the physically strong can stand a prolonged sojourn on the high ground: in fact over the whole district only those who are naturally healthy can expect to derive benefit; for those who need a delicate climate the meteorological conditions are unsuitable. An exception however must always be made in the case of Saltburn, where either extreme (of course with reference to the English climate) may be found as necessary. *There is a unanimous opinion that no person should go to the north-east coast during the spring months owing to the prevalence of the east winds; nor is the opinion less unanimous that summer and early autumn are the most favourable seasons at which persons may hope to stay in Northumberland, Durham and Yorkshire, particularly at the sea-coast portions of those counties, to the benefit of their health.*

MONTHLY MEANS FOR THE THREE YEARS 1881-1883.
 Station, ALNWICK, NORTHUMBERLAND. Height above Mean Sea-level, 213 feet.
 J. LINGWOOD, Esq., F.Met.Soc., Observer.

Month.	TEMPERATURE OF AIR IN MONTH.						WIND.						RAIN.	
	Atmosphere in Month.			Mean Temperature of Air in Month.			N.			E.			Days it fell.	Inches.
	1 Highest.	1 Lowest.	Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	N.	N.E.	E.	S.E.	S.	W.		
January.	51.5	18.8	32.7	42.0	31.3	10.6	1.3	0.6	2.6	7.3	8.0	9.3	12.0	1.83
February.	53.5	26.2	27.3	45.0	34.2	10.8	2.6	0.6	3.0	7.0	10.3	10.0	14.6	2.59
March.	56.8	23.4	33.3	46.2	32.9	13.3	3.6	0.3	4.6	4.6	3.6	11.0	17.0	2.47
April.	62.9	27.0	35.9	50.4	32.8	17.6	8.0	4.0	9.6	8.3	4.0	4.0	12.0	1.92
May.	70.0	30.8	39.2	58.4	40.6	17.6	8.0	3.6	3.6	5.3	7.6	10.0	11.0	2.59
June.	72.5	35.9	36.5	62.2	46.0	16.2	8.0	2.6	5.6	5.6	6.6	6.6	15.0	2.55
July.	74.1	42.4	31.7	66.1	50.3	15.8	1.3	1.0	1.6	5.3	11.0	10.3	18.6	3.69
August.	77.5	42.4	35.1	66.1	49.3	16.8	4.0	1.6	1.6	2.3	4.6	10.6	14.0	3.61
September.	68.4	38.2	30.2	60.6	46.9	13.7	8.3	3.3	1.0	5.0	8.0	6.6	18.3	3.43
October.	66.1	26.1	40.0	52.8	40.5	12.3	5.0	4.5	3.0	8.0	6.0	4.0	19.0	3.24
November.	58.6	24.7	33.8	47.5	36.1	11.4	1.0	1.0	0.5	5.0	6.0	14.0	21.0	3.19
December.	53.0	23.3	29.7	42.5	33.5	9.0	4.0	2.0	1.0	3.5	7.0	8.5	18.0	3.46

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE EIGHT YEARS 1882-1889.
 Station, CRAMLINGTON, NORTHUMBERLAND. Height above Mean Sea-level, 255 feet.
 W. ROWALL, Esq., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.						WIND.				MOON (Cloud).		RAIN.			
	Mean Pressure of Atmosphere in Month.	Monthly Range.			Mean of Air in Month.			N.				W.		Days of Fall.	Inches.	
		1 Highest.	1 Lowest.	Mean.	Highest.	Mean.	Lowest.	N.	E.	S.	W.	N.W.	W.			
January	29.621	52.98	23.26	37.62	42.61	32.55	10.06	25	24	3.2	1.9	11.2	18.0	1.25	6.61	1.84
February	29.644	54.60	21.61	32.98	44.11	32.12	12.00	38	4.7	3.5	3.5	12.1	12.2	11.3	6.61	1.06
March	29.565	50.11	21.00	38.11	45.28	31.81	13.47	38.55	5.1	6.6	2.7	6.0	12.6	12.5	6.17	2.14
April	29.985	63.12	26.58	36.53	49.52	35.65	13.87	42.96	8.7	7.0	4.2	7.3	7.6	7.0	6.96	1.84
May	29.921	70.26	31.28	38.97	55.65	39.86	15.78	45.25	8.7	11.7	6.6	5.2	10.1	11.7	5.5	1.75
June	30.064	73.93	36.85	37.08	61.20	45.70	15.30	33.46	4.0	10.6	5.6	3.4	8.8	10.6	6.88	1.40
July	29.871	70.61	39.82	36.48	64.86	48.48	15.92	36.90	1.1	8.7	3.2	3.6	11.1	11.2	6.88	1.82
August	29.900	75.32	39.32	36.90	61.46	48.46	16.00	36.46	4.36	6.6	2.5	2.7	12.2	16.5	7.90	3.29
September	29.884	68.78	35.02	33.76	59.95	44.92	15.02	32.42	8.93	7.6	2.1	5.0	10.2	13.2	6.56	2.51
October	29.839	62.24	30.33	32.74	52.61	39.74	12.87	46.01	8.25	4.3	3.8	4.3	11.0	13.1	6.34	2.84
November	29.814	57.41	25.60	31.81	46.78	35.68	11.40	41.21	8.10	3.6	3.5	4.0	12.1	15.3	6.56	2.53
December	29.831	53.63	19.45	34.48	41.82	31.40	10.72	36.51	8.25	2.8	1.2	4.3	11.8	17.2	6.25	2.208

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE SEVEN YEARS 1883-1889.
 Station, ROUSTRON, YORKSHIRE, N. Height above Mean Sea-level, 242 feet.
 Sir J. L. Bell, F.R.S., Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.										Mean Relative Humidity.	WIND.						RAIN.		
	1 Highest.		1 Lowest.	Monthly Range.	Mean of Highest.	Lowest.	Mean of Lowest.	Daily Range.	Mean Temperature of Air in Month.	N.			S.			Mean Cloud.	Days it fell.	Inches.		
										E.		S.E.	S.	S.W.	W.				N.W.	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.												
January	29.904	54.10	21.45	32.64	41.98	32.58	9.50	37.21	90.5	3.4	2.3	2.8	7.7	12.8	18.4	3.4	5.1	5.8	17.7	2.11
February	29.947	52.87	20.87	32.00	43.31	32.30	11.01	37.78	90.4	6.4	4.0	2.4	4.4	11.6	14.0	2.8	4.8	6.4	14.8	1.36
March	29.914	58.47	17.72	40.74	44.38	31.10	13.28	37.60	88.8	8.8	5.6	4.4	5.3	9.4	11.8	1.7	8.3	6.4	15.0	2.27
April	29.885	63.12	25.87	37.25	50.57	35.57	15.00	43.08	86.4	10.8	10.4	4.5	4.1	6.1	12.5	2.1	3.8	6.5	18.0	1.67
May	29.912	70.78	29.67	41.11	56.32	40.11	15.91	48.20	84.5	8.7	6.2	2.0	5.2	5.4	14.0	4.4	7.2	6.5	15.7	1.94
June	30.029	75.91	36.72	39.18	62.72	46.15	16.57	54.47	82.5	10.8	8.8	1.1	3.5	5.8	11.0	3.1	7.2	6.36	11.1	1.37
July	29.895	77.58	36.95	40.62	60.15	49.15	17.00	57.64	81.4	6.7	4.8	0.5	3.7	9.5	17.1	4.0	7.7	6.4	17.5	3.61
August	29.923	75.58	38.00	37.58	65.35	48.72	16.62	57.04	81.6	5.4	2.8	1.8	3.8	9.5	19.2	4.0	7.8	6.3	14.1	2.16
September	29.936	70.20	33.58	36.61	60.45	45.47	14.98	53.12	87.2	6.5	5.5	2.1	3.4	9.5	14.5	3.7	7.1	6.5	15.7	2.06
October	29.893	61.68	28.64	33.04	52.78	39.87	12.91	45.85	89.2	8.0	4.2	3.0	3.8	8.8	15.5	3.1	7.0	6.81	18.8	2.87
November	29.868	56.00	24.42	32.17	47.05	36.35	10.70	41.46	90.0	3.8	3.4	2.4	6.5	14.4	14.7	2.5	5.2	6.8	17.2	1.94
December	29.893	53.72	20.27	33.45	42.12	31.65	10.47	36.70	91.5	6.0	0.4	0.71	6.1	14.1	15.7	3.7	6.2	6.27	15.9	1.87

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE FIVE YEARS 1881-1885.

Station, AYSCARTH, YORKSHIRE, N. Height above Mean Sea-level, 658 feet.

REV. F. W. STOVÉ, Observer.

Month.	Mean Pressure of Atmosphere in Month.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity.	WIND.								Mean Cloud.	Days of Fall.	Inches.		
		Monthly Range.			Mean of Highest.	Mean of Lowest.			Mean Daily Range.	N.	N.E.	E.	S.E.	S.	S.W.	W.				N.W.	
		1 Highest.		1 Lowest.																	
January	29.655	50.10	21.52	29.70	40.10	31.86	8.24	35.79	80.46	3.8	1.2	5.8	2.6	1.2	17.0	12.2	5.2	17.4	4.664		
February	29.881	51.76	22.14	29.62	42.84	33.86	8.98	38.00	87.04	3.8	3.4	3.8	3.8	3.6	15.8	10.6	3.6	19.2	3.732		
March	29.957	53.62	22.90	33.72	44.26	32.16	12.12	35.42	81.72	4.6	5.8	3.6	3.2	4.0	11.6	13.2	7.2	16.8	3.244		
April	29.886	61.42	25.22	36.20	49.52	35.70	13.62	42.06	80.06	4.6	11.0	7.4	4.8	4.2	4.2	7.6	4.4	6.8	15.6		
May	29.951	70.70	30.06	40.64	56.34	39.84	16.50	48.06	76.22	6.6	5.0	5.2	2.4	3.4	1.8	11.4	2.4	9.0	13.8		
June	29.978	73.98	33.98	40.00	61.66	45.34	16.32	43.50	75.54	3.6	6.8	4.2	4.0	5.0	12.6	9.2	4.8	6.70	11.0		
July	29.902	75.62	40.68	34.94	65.24	49.64	15.60	36.66	81.66	2.2	3.6	2.2	1.2	4.6	20.6	12.2	4.6	6.64	17.4		
August	29.880	73.06	41.35	35.00	63.86	49.07	13.40	35.66	81.8	3.4	5.4	3.2	4.0	2.6	13.0	16.8	3.4	6.42	13.6		
September	29.888	67.82	36.02	31.80	59.34	45.36	13.98	31.76	80.76	4.4	5.6	4.0	3.0	3.6	13.8	9.0	3.8	6.62	18.4		
October	29.807	59.00	27.31	31.76	50.54	39.92	10.92	41.78	80.70	3.6	6.4	6.8	2.8	3.8	10.4	10.4	6.6	6.68	20.0		
November	29.822	56.18	23.58	32.60	45.70	36.38	9.92	40.76	80.00	2.6	5.0	3.2	2.0	5.0	18.6	12.8	4.0	6.60	19.8		
December	29.903	50.80	19.86	30.94	40.96	32.74	8.22	36.8	80.3	7.4	3.6	1.6	2.4	4.4	15.4	17.2	5.6	6.70	18.2		

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1880-1889.
 Station, SCARBOROUGH, YORKSHIRE, N. Height above Mean Sea-level, 129 feet.
 F. SHAW, Esq., F.Met.Soc., Observer.

Month.	TEMPERATURE OF AIR IN MONTH.						WIND.						RAIN.													
	Atmosphere in Month.			Mean Pressure in Month.			Mean Temperature of Air in Month.			Mean Relative Humidity.			Strength.			N.		E.		S.		W.		Mean Cloud.	Days it fell.	Inches.
	1 Highest.	1 Lowest.	Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Range.	Mean Temperature of Air in Month.	Mean Relative Humidity.	Strength.	N.		E.		S.		W.										
										N.	N.E.	E.	S.E.	S.	N.W.	W.	N.W.									
January	29.486	32.1	25.0	27.1	41.6	34.2	7.4	38.0	90.1	2.52	2.8	4.7	3.0	5.4	5.2	20.1	13.6	6.5	6.6	15.3	1.852					
February	29.830	32.7	28.7	24.0	43.7	35.6	8.1	39.4	87.9	2.66	3.6	6.6	2.5	5.1	6.1	14.8	11.0	6.1	6.4	16.2	1.831					
March	29.922	38.9	26.7	32.2	44.5	37.3	10.1	39.9	86.5	2.54	5.3	8.0	6.2	5.9	3.9	12.3	10.4	9.4	6.1	15.8	2.091					
April	29.885	42.7	32.5	30.1	49.5	39.0	10.5	44.1	84.4	2.16	6.8	15.7	6.8	5.8	4.1	9.0	6.6	4.0	6.2	16.8	2.172					
May	29.964	49.9	35.8	34.1	55.5	43.6	11.9	49.4	78.5	1.89	10.9	9.7	5.4	4.3	4.5	12.9	8.7	6.1	5.7	14.5	1.809					
June	29.992	52.6	42.3	30.3	60.9	49.4	11.5	54.9	81.9	1.92	10.3	9.1	5.6	4.7	4.9	10.0	7.8	5.7	6.4	12.5	1.690					
July	29.883	55.9	45.6	30.3	65.5	52.9	12.6	58.9	79.4	1.88	6.5	4.0	3.3	4.8	6.0	20.5	10.9	5.0	6.3	16.5	2.375					
August	29.907	55.0	45.2	29.8	64.4	52.6	11.8	58.2	89.7	2.00	8.1	5.2	2.6	4.6	4.8	12.8	12.5	8.8	6.1	14.5	2.164					
September	29.984	60.4	41.5	27.9	60.3	49.8	10.5	54.1	85.6	2.10	7.3	6.2	3.7	6.7	3.2	11.8	11.0	7.5	6.1	16.3	2.516					
October	29.885	62.3	33.9	28.3	52.5	43.0	9.5	47.4	86.3	2.72	6.9	7.3	6.7	4.8	3.6	12.9	10.3	8.4	6.5	19.3	3.246					
November	29.888	57.2	31.4	25.8	47.6	39.6	8.0	45.5	87.6	2.46	2.8	4.4	4.5	4.4	5.7	17.6	13.4	5.4	6.2	17.5	2.532					
December	29.858	52.5	25.9	26.5	42.8	35.1	7.7	39.0	89.5	2.46	4.1	3.9	2.2	2.9	4.0	21.1	14.6	8.1	19.3	2.351						

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE TEN YEARS 1880-1889 (with the exception of the year 1885).

Station, BRADFORD, YORKSHIRE, W. Height above Mean Sea-level, 366 feet

J. McLEANDER, Esq., Observer.

Month	TEMPERATURE OF AIR IN MONTH.										WIND.				RAINS.	
	Mean Temperature of Month.	Maximum.	Minimum.	Monthly Range.	Mean of High.	Mean of Low.	Mean of Mean.	Mean of Maximum.	Mean of Minimum.	Hourly Mean.	N.	E.	S.	W.	Mean (Feet).	Total (Inches).
January	39.25	57.0	21.0	36.0	47.7	34.0	8.0	35.7	38.0	36.8	0.6	1.7	0.8	1.2	1.1	1.3
February	39.00	52.3	21.0	31.3	45.7	32.7	8.0	36.7	38.0	37.3	0.7	0.8	1.0	1.7	1.0	1.03
March	39.45	57.0	21.0	36.0	47.7	34.8	10.0	36.4	38.0	37.2	0.8	0.6	1.7	0.8	1.0	1.41
April	39.75	63.4	30.0	33.4	51.0	38.0	13.0	42.0	45.0	43.5	0.0	1.0	1.0	0.0	1.0	1.50
May	39.75	77.0	36.1	40.9	59.5	44.7	14.7	50.0	57.0	53.4	0.4	1.4	1.4	0.0	0.4	1.85
June	39.62	79.0	41.0	38.0	61.0	46.0	15.0	53.1	57.0	55.0	0.0	0.8	0.0	1.0	0.0	1.85
July	39.46	77.5	41.0	36.5	60.8	46.5	14.3	56.5	57.0	56.7	0.0	0.4	0.0	1.0	0.0	1.50
August	39.00	78.0	41.0	37.0	60.7	46.5	14.2	56.5	57.0	56.7	0.0	1.1	0.0	1.1	0.0	1.50
September	39.00	74.0	40.0	34.0	60.0	46.0	14.0	56.0	57.0	56.5	0.0	0.0	0.0	1.0	0.0	1.50
October	39.00	61.0	35.0	26.0	55.0	40.0	15.0	47.5	50.0	48.7	0.4	0.0	0.0	0.0	0.4	1.50
November	39.45	60.0	38.0	22.0	51.8	38.7	8.0	42.0	45.0	43.5	0.0	0.0	0.0	0.0	0.0	1.50
December	39.45	60.0	34.0	26.0	51.4	36.0	8.0	43.0	45.0	44.0	0.0	0.0	0.0	0.0	0.0	1.50

(Highest and Lowest = Absolute Highest and Lowest in Period)

MONTHLY MEANS FOR THE TEN YEARS 1880-1889 (with the exception of the year 1885).

Station, HULL, YORKSHIRE, E. Height above Mean Sea-level, 12 feet.

E. PEAKE, ESQ., Observer.

Month.	TEMPERATURE OF AIR IN MONTH.						WIND.				RAIN.						
	1 Highest.		1 Lowest.		Monthly Range.		Mean of		Mean Monthly Direction.	Strength.	N.	E.	S.	W.	Mean Cloud.	Days it fell.	Inches.
	Atmosphere in Month.				Highest.	Lowest.	Monthly Range.	Mean of									
January.	30.016	52.4	19.9	39.2	41.4	31.1	10.3	36.9	86.1	139	1.5	1.6	11.1	10.8	6.55	14.7	1.79
February.	29.975	53.4	21.5	28.9	44.0	32.8	11.2	39.0	85.4	148	5.9	5.1	8.9	8.4	6.33	16.9	1.80
March.	29.903	59.5	21.3	38.2	46.9	32.5	14.4	40.9	83.7	137	6.1	6.9	7.5	10.5	5.96	16.7	2.07
April.	29.873	64.0	27.7	36.3	51.6	36.4	15.2	43.9	77.1	142	7.3	8.1	8.0	6.8	6.73	17.4	1.95
May.	29.829	71.5	32.0	42.5	60.1	41.8	18.3	50.5	76.1	148	5.6	8.0	7.3	10.1	5.65	13.5	1.89
June.	29.917	77.5	38.4	39.1	65.1	47.1	18.0	56.2	75.3	133	6.8	6.2	7.7	9.3	6.6	11.9	1.61
July.	29.897	78.7	40.6	38.1	68.9	51.1	17.8	59.2	78.0	129	1.8	4.8	8.1	13.1	6.7	16.7	2.76
August.	29.916	79.7	40.7	39.0	68.5	50.2	18.3	58.8	78.1	106	1.9	1.4	6.3	11.1	5.8	15.1	2.71
September.	29.933	72.9	37.3	35.6	62.9	47.1	15.8	51.7	79.1	117	3.7	5.7	7.9	10.8	5.7	15.3	2.37
October.	29.861	62.5	30.3	32.2	53.5	40.1	13.4	47.1	82.2	160	6.6	6.3	6.6	11.1	6.0	19.3	1.00
November.	29.837	57.7	26.1	31.6	48.2	37.2	11.9	42.7	85.1	145	1.1	3.9	9.2	12.7	6.0	17.2	2.02
December.	29.893	52.4	22.4	30.0	42.1	31.6	10.5	35.9	85.6	136	5.5	3.2	9.2	13.0	5.7	17.6	2.34

1 Highest and Lowest.—Absolute Highest and Lowest in Period.

MONTHLY MEANS FOR THE FIVE YEARS 1885-1889.

Station, USHAW, DURHAM. Height above Mean Sea-level, 600 feet.

REV. J. CORBISHLEY, Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.							RAIN.		
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature of Air in Month.	Mean Relative Humidity.	Mean Cloud.	Days it fell.	Inches.
January.	53·70	22·08	40·4	31·02	9·38	35·74	93·0	7·06	19·0	1·78
February	53·24	21·88	41·34	31·08	10·26	36·20	89·2	6·76	14·4	1·05
March	56·68	20·90	43·32	31·58	11·74	37·46	87·8	7·08	16·4	3·31
April.	63·32	28·52	48·78	35·32	13·46	42·04	82·2	7·26	16·8	2·00
May.	69·86	32·86	55·26	40·56	14·70	47·32	80·0	7·24	15·8	2·45
June.	74·42	36·32	62·38	46·40	15·98	54·38	74·8	6·86	7·4	1·23
July.	77·46	41·56	64·96	49·98	15·18	57·38	73·7	7·08	14·2	3·73
August.	72·62	40·62	63·06	49·20	13·86	56·12	79·4	6·74	14·8	2·24
September.	68·26	35·22	58·96	45·46	13·50	52·22	83·2	6·74	13·4	2·19
October.	59·88	32·30	50·76	40·30	10·46	45·52	87·8	7·06	17·8	3·29
November.	57·40	28·08	46·18	36·80	9·38	41·70	90·4	6·72	15·0	3·10
December.	53·06	21·94	41·10	31·64	9·46	36·36	90·4	5·96	13·8	1·72

1 Highest and Lowest = Absolute Highest and Lowest in Period.

THE CLIMATE OF NORTH WALES

By D. J. LEECH, M.D., D.Sc., F.R.C.P.

IN giving an account of the climate of North Wales, I propose to deal with that part of the Principality which has for its southern boundaries Bala Lake and the Dee on the east, and the rivers Twrch and Dovey on the west. This area includes the counties of Flint, Denbigh, Carnarvon, the Island of Anglesey, and a large portion of Merionethshire, and takes in the coast-line as far as Aberdovey.

Physical Configuration.—North Wales is for the most part a country of mountains and moorland intersected by valleys, few of which are wide and sunny enough for the residence of invalids, but the relation of the mountains to the coast gives special climatic advantages to the many seaside places which are dotted along the coast between Prestatyn and Aberdovey.

The huge mountain range in Carnarvonshire of which Snowdon is the centre, sends spurs north, south and west, which terminate towards the coast in varied ways. Northwards they approach it closely, and in an irregular fashion, some of the headlands projecting seawards. Two of them enclose a well-sheltered area on which Penmaenmawr is situated. At Llanfairfechan the mountains recede from the coast, and a wide strip of level land forms for the most part the Carnarvonshire boundary of the Menai Straits, though here and there small outlying hills approach the shore. The hills which project from the flat table-land of Anglesey in the north and west of the island, may be looked upon as the western termination of the Carnarvonshire range.

To the south-west the Snowdonian range sends a high ridge

into the northern part of the peninsula of Llyn, and ends in isolated hills rising from a flat table-land.

On the south side of the peninsula the spurs of the main range do not reach the sea except at Criccieth, but the land north of Pwllheli is sufficiently high to give protection to the town.

A broad stretch of low-lying land at the north-eastern extremity of Cardigan Bay separates the hills of Carnarvonshire from those of Merionethshire, and allowing as it does a free passage to the south-west winds, plays some part in the distribution of the rainfall.

The mountains of Merionethshire vary considerably in the extent to which they extend coastward. At Harlech, Barmouth and Aberdovey they approach the sea closely, but between these places, as at Towyn, a wide tract of flat land intervenes between the sea and the hills.

The eastern portion of North Wales, which includes the counties of Denbighshire and Flintshire, is separated from Carnarvonshire by the wide valley of the Conway, and intersected from north to south by the still wider valley of the Clwyd. The high mountains in the southern portion of Denbighshire and the north of Montgomeryshire are directly continuous with the Carnarvonshire range, and owing to this a barrier to the full force of the water-laden south-west winds is formed, which extends from the north coast to the valley between Bala Lake and Corwen. This barrier, which is only broken at one place by the high valley between Capel Curig and Bettws-y-Coed, has an important climatic influence on the eastern portion of North Wales.

Both Denbighshire and Flintshire have ranges of hills running through their centre from south to north, but they terminate northward in quite a different manner in the two counties. The northern contour of the Denbighshire range is very irregular in outline like that of the Carnarvonshire hills. Some prolongations reach the sea, and isolated sentinels—the Great and Little Orme—stand out beyond the range itself. Between these prolongations and hills are well-sheltered districts, open northward indeed, but more or less protected from other quarters, and on them are located the health resorts of Colwyn Bay, Llandudno, Llandulas and Abergel.

The Flintshire hills, on the other hand, terminate by a low

range, with a more regular outline running parallel with and some distance from the sea and the estuary of the Dee, and affording therefore but little shelter. Only one health resort is here found, Prestatyn, and this, like Rhyl, which is in the middle of the terminal portion of the valley of the Clwyd, owes its popularity to its openness rather than the shelter it receives.

Geology.—In the western portion of North Wales the rocks belong almost entirely to the Cambrian and Lower Silurian age, or are of igneous origin. In Anglesey, however, in one or two small areas we meet with the coal measures and the Old Red Sandstone. On the north-eastern side of the island too, there is a considerable amount of carboniferous limestone, and a narrow area of this formation can be traced for some little distance parallel to the Straits on both the Anglesey and Carnarvonshire sides.

The greater part of Denbighshire is Upper Silurian (Wenlock shale); but carboniferous limestone is met with on the eastern border of this county and on the sea-coast almost as far as Colwyn Bay. Further westward detached portions of this conformation form the Great and Little Orme. On each side of the valley of the Clwyd, at its northern part, the coal measures appear for a short distance, but in the valley itself we meet with rocks of the Triassic age and deep alluvial deposits. In the hilly districts in the centre of Flintshire is a wide tract of carboniferous limestone, and to the east of this the coal measures are found again.

Coast Aspect.—We do not usually associate exposure to north winds with warmth, yet on that part of the coast of North Wales which is unprotected from the north, the average temperature is high, and there are several places well adapted for the residence of invalids in the cold months of the year. But the hills rise near the sea on this coast, and any injurious influence which the cold north winds might otherwise exert, seems to be prevented or at least limited by the background of high land against which they blow. Where this high ground fails, the condition of the vegetation gives evidence of an effect exerted by the wind: the trees, for example, lose their symmetry and are cut off on their northern side. But where the southern hill barrier is near enough, the vegetation is unaffected, provided there be also protection from

other winds.¹ It is from the west and south-west winds especially that protection is required in the cold months of the year, and apart from such protection, health resorts are not as a rule found. Save at a few spots on the Menai Straits there are none on the west coast from Bangor to the end of the peninsula of Llyn. On the western shore of Cardigan Bay are two small watering-places, Abersoch and Llanbedrog, which are beginning to attract visitors in the winter, and Pwllheli and Criccieth on the northern shore have a mild temperature in the winter months. But on the coast south of this there is only one place looking west (Barmouth), which is at all adapted for a winter residence. Here the hills rise up immediately on the eastern side of the town, and limit the force of the west winds as the mountains on the north coast limit that of the northerly winds. Aberdovey is warm throughout the year, but though on the west coast, it looks southward.

Meteorology.—Rainfall.—The rainfall in North Wales is on the whole, high (see Map, page 128), but it varies greatly in different localities as will be seen from the following tables taken, except in the case of Barmouth, from the records published by Mr. G. J. Symons, F.R.S.

RAINFALL IN NORTH WALES.

	Height in feet above Sea-level.			Period of Observation.		Average Annual Rainfall in inches.	
Holyhead	...	44	...	1866-1890	...	...	34·45
Carnarvon	...	120	...	1866-1890	...	...	34·45
Criccieth	...	49	...	1893-1898	...	...	34·03
Barmouth	...	—	...	1878-1898	...	...	41·97
Llandwrog	...	100	...	1893-1895	...	...	44·19
Llanberis	...	370	...	1893-1898	...	...	69·40
Capel Curig	...	1168	...	1893-1898	...	...	70·22
Festiniog	...	1060	...	1893-1898	...	...	111·48
Dolgelly	...	465	...	1893-1898	...	...	64·25
Llangollen	...	440	...	1893-1898	...	...	38·23
Llanfairfechan	...	150	...	1871-1890	...	...	39·25
Llandudno	...	99	...	1866-1890	...	...	31·28
Colwyn Bay	...	125	...	1893-1898	...	...	29·74
Rhyl	...	21	...	1893-1898	...	...	23·91
St. Asaph	...	173	...	1888-1898	...	...	25·41
Denbigh	...	447	...	1891-1898	...	...	31·07
Halkyu	...	895	...	1893-1898	...	...	29·51

The west and south-west winds often reach the shores of Great Britain rain-laden, though the former are perhaps somewhat

¹ For an analogous instance of protection afforded by a background of high land compare the state of affairs at Malvern (pp. 139-140).

relieved of their moisture in passing over the south of Ireland. They deposit their watery contents on the first high lands they meet. The greater part of Anglesey is flat, hence the amount of rain is not excessive. It is only 34 inches at Holyhead, though on the higher lands in the island it reaches 36-38 inches or more. Where the hills do not approach the shore very closely, as at Carnarvon and Criccieth, the amount of rain is moderate, but where, as at Barmouth, but little space is left between hill and sea, much rain falls.

In the mountainous regions of Carnarvonshire and Merionethshire, the ranges of these two counties form a continuous high barrier, and on them is deposited a considerable portion of the moisture with which the west and south-west winds are charged. Some of the rain-laden winds pass over the low-lying land between Carnarvonshire and Merionethshire and through the valley leading by Beddgelert and Capel Curig into the higher part of the valley of the Conway, and hence the rainfall here is somewhat large. East of this come the high lands of Denbighshire which cause a further precipitation of moisture in the form of rain, so that when the south-west and west winds reach the valley of the Clwyd, they have become drier, and in this valley and on the Flintshire hills there is a comparatively small rainfall. Northward we find that at Llanfairfechan, which lies west of the northward projection of the Snowdonian range, it is somewhat heavy. At Llandudno, which is protected by the Great Orme's Head, it is less, and it decreases eastward until at Rhyl, where there are no surrounding hills to precipitate the moisture, the rainfall is less than in most parts of Great Britain.

Humidity.—The air of North Wales generally is humid rather than dry. Many of the valleys are very damp, so also are some of the more level areas, as for example certain parts of the promontory of Llyn. On the other hand the air of the coast generally is not damp, and that of the north coast is distinctly dry. At Llandudno the average percentage of humidity recorded during fifteen years, 1881-1895, was 78·5, for the corresponding years at Ilfracombe 85, at Torquay 80·8, Ventnor 81·2, Blackpool 83·1, Scarborough 84·1, [at Rhyl 78·7 for the ten years 1881-1890].¹

At Colwyn Bay the records extend over a much shorter period :

¹ For further details see also pp. 127 and 141.

but it would appear as if the degree of humidity is even less than at Llandudno. In 1894–1895 it was 77·7, whilst in the same year at Llandudno it was 78·7, at Torquay 80·4, at Blackpool 81. Two causes probably lead to the dryness of the air on the North Welsh coast: the removal of much of the moisture from the prevailing winds by the adjacent high lands, and the geological formation which tends to rapid removal of the moisture from the surface of the land. The carboniferous limestone crops out only in a few places, but in many other parts there is a drift deposit above the rock which allows of ready drainage. Fog is not frequent; mists of course come down from the hills, or rise from the sea, but dense fogs are extremely rare.

No record with regard to the humidity of the west coast of North Wales and in Cardigan Bay are available, but there is reason to believe that there is at least no excess of moisture in the air. Fogs are undoubtedly less common than at many places on the south coast of England.

Temperature and Sunshine.—A marked feature of the climatology of North Wales is the comparatively high temperature which prevails on the coast in the colder months. In passing from Chester westward in the winter on the line which skirts the sea-shore, the influence of less rigorous atmospheric conditions is often very noticeable. If there has been a snowy landscape eastward, the snow gradually disappears; dull, cold weather is often replaced by bright sunshine and mild air, and in the protected parts beyond the valley of the Clwyd the vegetation gives evidence of marked improvement in the climatic conditions. The temperature of this part of the coast in winter indeed, does not differ very materially from that of the south coast of England.

The *Meteorological Atlas* of the British Isles, published by the authority of the Meteorological Council, represents the isothermal lines as passing almost directly northward from the south-west of England to the north of Wales between October and April; the isotherm of 42 for December and January being drawn along the southern coast to the neighbourhood of Exmouth, whence it runs northward to Llandudno, whilst Torquay and Pwllheli are placed on the same isotherm, 43.¹

According to Dr. Nicol, the average annual temperature of

¹ Compare also the Isothermal Maps on p. 335 of this volume.

Llandudno was practically the same between 1861 and 1881 as that of Bournemouth (50·5 and 50·3 respectively), whilst between 1874 and 1881 it was somewhat lower at Brighton (49·9); but in the series of years 1881–1890 the average annual temperature of Llandudno was only 49·2, and therefore slightly lower than that of the winter health resorts on the south coast. The difference is noticeable in all quarters of the year, but is most marked in the summer, as will be seen from the following table in which Blackpool and Scarborough are included in order to illustrate the variations between the climate of Llandudno and bracing places on the east and west coasts of England :—

AVERAGE MEAN TEMPERATURE OF THE AIR AT LLANDUDNO
DURING THE YEARS 1881–1890.

	Fourth Quarter, Oct.—Dec.	First Quarter, Jan.—March.	Second Quarter, April—June.	Third Quarter, July—Sept.
Llandudno . . .	46·0	41·2	51·5	58·1
Torquay . . .	47·0	41·7	51·6	58·5
Ventnor . . .	46·6	42·0	52·9	60·5
Falmouth . . .	47·1	43·2	51·6	59·1
Scarborough . .	43·4	40·6	49·6	56·7
Blackpool . . .	42·1	40·3	49·7	53·2

The weather at Llandudno is not only mild but equable: the mean of the lowest daily temperatures in the first quarter of the year for the ten years being 36·4, whilst the daily range between October and March was only 8·8. The annexed table of absolute minimum temperature likewise points to the comparative equability of the winter climate :—

EXTREME MINIMUM TEMPERATURE AT LLANDUDNO
DURING THE YEARS 1881–1890.

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year.
Llandudno	14·5	17·5	22·5	27·2	32·4	40·4	42·0	43·4	38·5	29·0	29·0	20·0	14·5
Torquay	14·0	21·3	21·3	26·4	33·0	39·9	44·4	43·6	35·4	27·3	22·3	20·4	14·0
Ventnor	14·9	20·4	22·7	29·8	33·5	39·4	43·3	45·3	37·1	31·1	21·9	21·2	14·9
Falmouth	19·5	21·8	23·1	29·0	34·6	41·6	46·6	43·0	37·5	31·0	22·3	24·4	19·5
Scarborough	10·0	8·1	22·4	27·9	28·1	39·7	41·3	40·0	35·5	27·0	26·5	18·3	8·1
Blackpool	0·5	9·9	18·6	24·3	28·7	35·0	41·0	36·2	30·1	19·1	22·7	15·3	0·5

The temperature will of course vary a little in different places on the coast. Colwyn, for example, according to Dr. Lord has a

slightly higher temperature in the first quarter of the year (41·5) and a lower average in the summer months; but the records of Llandudno may be taken to represent generally the climate of the north-west coast, at least of those parts of it which receive protection from the hills.

The vegetation indicates the climatic conditions which prevail. The bay-tree and the laurustinus and the fuchsia flourish not only at Llandudno, but at all the sheltered resorts. The myrtle may be seen growing freely in the open air at Penmaenmawr, and the Eucalyptus Globulus has been known to attain a height of 35 feet at Colwyn.

In connection with the temperature it is worthy of note that the snowfall on the north coast of Wales is small. At Llandudno the average number of days in which snow fell in each year from 1881-1890 was 10, at Torquay 20, at Buxton 44, and even those figures do not fully represent the slightness of the snowfall: even on the days on which snow is noted, the amount is so little that it rarely lies long.

It has been pointed out that in passing westward along the North Welsh coast the weather usually becomes brighter as well as milder, but the official records show that the actual amount of sunshine during the winter months is less than on the south coast.

In the first and fourth quarters of the years 1885-1890 the percentage number of hours of possible sunshine was 29 at St. Leonards, 27 at Ventnor, 28 at Falmouth, and 20 at Llandudno. Sunshine was however only noted in the last-named place in each quarter during four of the years between 1885 and 1890, and in one of these quarters the instrument was not in a satisfactory position. But the difference between the amount of sunshine recorded at Llandudno and the other places mentioned cannot be thus accounted for. Moreover in the succeeding four years, 1891-1894, St. Leonards averaged 34 per cent. of sunshine during the first and four quarters, Falmouth 32, and Llandudno 29. In some years the percentage of sunshine on the North Welsh coast compares more favourably with other places than it did in the periods I have alluded to. Dr. Lord, for example, who has for many years kept records of the meteorology of Colwyn Bay, shows that in 1894-1896 Colwyn Bay rivalled Torquay and

Penzance in the total number of hours of sunshine during the winter months. Between October and December there were recorded at Colwyn Bay 208 hours of sunshine, at Torquay 206, at Penzance 217. From January to March the numbers were for Colwyn Bay 303·6, Torquay 291·7, for Penzance 306·9. The sources of fallacy in observations in regard to the amount of sunshine are so numerous, that slight or even considerable variations in the number of hours recorded at different stations, prove very little. On the whole it seems probable that the winter health resorts on the south coast of England have the advantage of a greater number of hours of sunshine during the winter months than the North Welsh coast. But there is reason to believe that this is not the case with regard to the number of sunless days. Taking the years 1895, 1896, and 1897, the only years available for comparison, Colwyn Bay had an average of 46·6 sunless days, Torquay 58, Penzance 87. In the winter quarters alone the average of sunless days for the three years was Colwyn Bay 44, Torquay 49, Penzance 61. Here too comparison is difficult owing to the want of similarity of methods of observation. It may well be however, that though there is less sunshine, there may be fewer sunless days on the North Welsh coast owing to the moods of the weather being more variable, and the general impression of winter visitors seems in accord with this view.

In Anglesey the average winter temperature is high. At Holyhead during the 25 years ending 1895, the mean temperature in January, February and March was 42·2, whilst it was 41·9 at Llandudno. Between October and December it was 45·9 at Holyhead, and 44·3 at Llandudno. Nevertheless the mean average temperature at the two places was exactly the same, showing that the winter is slightly warmer and the summer slightly cooler at Holyhead.

Along the shores of the Menai Straits signs of winter mildness are in many places seen, and at Carnarvon the meteorological records with which the medical officer of health, Dr. Fraser, has furnished me, show a temperature very much like that of Holyhead. Records have only been kept here since 1894, but in the four years 1894 to 1897 the average temperature for the first quarter of the year was 42·2, whilst that of the last quarter was 45·6.

South of Carnarvon we find some indications of a warm winter climate, but except at Barmouth, no meteorological records are available. From records supplied to me by Dr. Lloyd of Barmouth, I find that the average temperature of the first quarter of the year between 1888 and 1897 was $40^{\circ}9$, whilst that of the fourth quarter was $44^{\circ}7$, both averages being about a degree lower than at Llandudno. The records however are not of course strictly comparable with those of the latter place, since they concern a different series of years. Save at Barmouth where hills rise immediately behind the town, the vegetation shows but little indication of winter warmth on those parts of the coast which look directly westward. But on the western and northern sides of Cardigan Bay, at Abersoch, Llanbedrog, Pwllheli, and to some extent at Criccieth, the vegetation gives evidence of equability of climate and absence of severe weather in the winter.

Aberdovey, which looks southward on the estuary of the Dovey, is probably the warmest place on the North Welsh coast in winter, but no meteorological data are available, although observations have recently been commenced. There are no means of determining the comparative amount of sunshine in the various places on the west coast of North Wales, nor is there any record of the snowfall, although there is reason to believe that it is as small on the west coast as it is on the north.

In the summer months the health resorts on the coast of North Wales being exposed to the north and west winds have probably a lower temperature than those of the south coast of England. This is certainly the case so far as the north part of the Welsh coast is concerned. Whether it is so at Pwllheli and Criccieth has yet to be ascertained. Aberdovey has the reputation of being extremely warm in the summer.

It may be interesting to consider briefly the cause of the comparatively high temperature of the Welsh coast in winter. The warmth of the western portion is doubtless due to the Gulf Stream, which runs northward through the Irish Channel. According to the *Meteorological Atlas*, in the first and fourth quarters of the year the average temperature of the sea in Cardigan Bay ($49^{\circ}3$) is much the same as that of the water on the coast of Dorsetshire and Devonshire. Northward, the temperature of the water falls somewhat. In Carnarvon Bay it only

averages $48^{\circ}5$ and at Holyhead $47^{\circ}5$. But further east at the lightship off Liverpool it has fallen to $45^{\circ}3$.

It seems then that the sea on the north coast of Wales is cooler than either on the west coast or south coast of England during the winter months, and that the mildness of the north coast is not altogether due to the influence of the Gulf Stream. Two other factors in climatology probably influence it: air deprived of its moisture becomes not only drier but warmer, and much of the air which blows on the Welsh coast has passed over high lands before reaching it, and has thus been to a certain extent depleted of its moisture. The west and south-west winds occur far more frequently than any others in North Wales: the west winds have passed over Ireland and the hilly parts of Anglesey, whilst the south-west winds have had to cross still higher lands to reach the coast. The second factor is the protection from west winds which is afforded to much of the north coast of Wales, by the hills which run northward and terminate at or near the sea.

The west wind is not a cold wind but is often vehement, lowering the temperature of the air somewhat, and rendering those parts of the coast which are fully exposed to it unsuitable for winter quarters. From the west and east winds all the health resorts on the north coast of Wales are more or less protected. They are indeed exposed to the north, north-west and north-east winds, but the records at Llandudno show that in the ten years 1881-1890 these were only observed here on an average 76 times during the year, whilst the west and south-west winds were noted on 303 occasions.

Concerning the climatic conditions of the inland parts of North Wales, no records are available. In the winter the temperature doubtless for the most part is low, though in some of the wider valleys, as for example, at Trefriw, the weather is fairly mild, and here and there, even in the mountainous parts, a few protected spots are said to be exceptionally warm. In the summer the higher lands are cool and bracing, but most of the valleys are too narrow and close to afford suitable resting-places for invalids.

Prevalence of Disease.—The incidence of various ailments in special localities will be alluded to later on, but reference may be here made to the general distribution of two or three of the more important.

Malaria.—Until comparatively recently there were ague districts in North Wales. Dr. Lloyd Roberts of Denbigh states that malaria was prevalent in the flat district near Rhuddlan until drainage was established by the construction of a series of dykes in the neighbourhood of Prestatyn, and according to Dr. Jones Morris of Portmadoc the reclaimed land in the valley running up towards Aberglaslyn was an ague-producing district long after the sea had been prevented flowing over it in the early part of the last century. Dr. Eyton Lloyd of Rhyl says that even yet there are people living where the Clwyd valley opens out towards the sea who suffer from malarial affections contracted in earlier times. But there is no evidence that it now originates either there or in any other part of the Principality.

Phthisis.—According to the returns of the Registrar-General, the death-rate from phthisis is higher in North Wales than in England and Wales generally. The annexed table however shows that there was a considerable fall in the mortality from phthisis in the decade ending 1891, and that this decrease was slightly more marked than the similar diminution which occurred in England.

		Deaths per 1,000 from all causes.	Deaths per 1,000 from Phthisis.
1871-1881	{ England and Wales	21·27	2·116
	{ North Wales	20·59	2·574
1881-1891	{ England and Wales	19·08	1·724
	{ North Wales	18·68	2·112

The following table, which gives the mortality per 1,000 living in the various registration districts into which the part of North Wales here dealt with is divided, indicates the comparative mortality of phthisis in the ten years ending 1891:—

Wrexham	1·46	Pwllheli	2·06
Conway	1·78	St. Asaph	2·09
Holywell	1·78	Llanrwst	2·22
Corwen	1·86	Holyhead	2·24
Bala	1·88	Anglesey	2·32
Ruthin	1·94	Festiniog	2·51
Dolgelly	2·01	Bangor	2·52
		Carnarvon	2·96

The names given above correspond to large areas, and the mortality bears no necessary relationship to that of the town from which the district is named. Pwllheli, for example, includes the whole of the Llyn peninsula in which the death-rate is distinctly higher than in Pwllheli itself. It will be seen however that the

mortality from phthisis in North Wales is higher in the west than in the east: this is specially seen in the mountainous districts, but it is noted too in the flat table-land of Anglesey. It has been suggested that the high death-rate from phthisis in Wales is apparent rather than real, that there is a tendency in the Principality to return under the heading of phthisis, deaths which would elsewhere appear under the classification of other respiratory diseases, and undoubtedly whilst the deaths recorded from phthisis are more numerous, those classified under the heading of respiratory diseases, other than phthisis, are less numerous than in England and Wales.

But from officers of health and practitioners there is abundant evidence that in many parts of North Wales, and especially amongst the inhabitants of damp narrow valleys, and where the house accommodation is defective, the mortality from phthisis is excessive. For the following table, which gives the recent phthisis death-rate in several well-known urban districts in Carnarvonshire, I am indebted to the reports of Dr. Fraser, the officer of health for that county, who has kindly placed them at my disposal. The average death-rate from phthisis in England and Wales for the five years ending 1897 was 1·38, the average death-rate from all causes being 17·8:—

Death-rate.			Death-rate.		
All causes.		Phthisis.	All causes.		Phthisis.
Llandudno	13·5	... 0·9	Pwllheli	19·1	... 1·6
Colwyn Bay	11·0	... 1·2	Conway	19·5	... 1·8
Penmaenmawr	14·5	... 1·2	Bangor	18·17	... 1·8
Criccieth	14·1	... 1·5	Carnarvon	18·5	... 1·9
Llanfairfechan	14·7	... 1·6	Menai Bridge	29·5	... 2·6

The medical officer of health for Rhyl, Dr. Eyton Lloyd, has furnished me with statistics which show that the general death-rate during the five years ending 1897 in this urban district was 19·6, whilst the death-rate from phthisis was 1·3. The death-rate from phthisis in the Abergele sub-registration district which includes six rural parishes and the urban council district of Abergele and Pensarn is, according to Dr. Lloyd Roberts, 1·3.

It is not easy to explain the high death-rate from phthisis in certain places, as for example Menai Bridge: it is possible however, if a longer series of observations could be given we should find the death-rate smaller. The prevalence of phthisis in North

Wales seems largely due to the bad housing of the working-classes, especially in country districts, and perhaps in part to the dampness of many localities. Dr. Fraser's reports show that in Carnarvonshire the death-rate in rural districts is higher than in urban districts, and the cramped ill-ventilated cottages common in North Wales must encourage the growth of the tubercle bacillus. It is probable that a limited supply of food was formerly an important factor in predisposing to consumption, and even now the diet of the labouring classes may have some effect in this direction. Dr. Lloyd Roberts has pointed out that it leads to the prevalence of an excessive amount of digestive troubles, and defective nutrition may ensue from this cause. From the prevalence of phthisis in the mountainous districts of the west part of North Wales it would seem that a home for those predisposed to this ailment should not be sought here; on the other hand in most of the health resorts on the west coast there is no excess of phthisis, whilst on the north coast and in the eastern part of North Wales the mortality from this ailment is below the average.

Tabes Mesenterica and other Tubercular Affections.—

The returns of deaths under these headings furnished by the Registrar-General from North Wales are lower in comparison with the population than those from England and Wales generally, but these returns are liable to so much error that a detailed account of them would serve no purpose.

Diphtheria, Scarlet Fever, and Typhoid Fever.—These ailments are not specially prevalent in North Wales. The death-rate from diphtheria indeed is slightly higher than in England and Wales generally, but scarlet fever and typhoid fever contribute less to the mortality.

DEATH-RATE PER 1,000 LIVING (1880-1891) IN REGISTRATION DISTRICTS.

	Diph.	Scarlet Fever.	Typhoid Fever.			Diph.	Scarlet Fever.	Typhoid Fever.
England and Wales	·163	·334	·196	Pwllheli ...	...	·39	·18	·10
N. Wales ...	·166	·263	·153	St. Asaph ...	...	·17	·17	·17
Wrexham ...	·15	·35	·11	Llanrwst ...	...	·16	·08	·09
Conway ...	·27	·10	·14	Holyhead ...	...	·22	·08	·12
Holywell ...	·13	·38	·18	Anglesey ...	...	·15	·12	·10
Corwen ...	·09	·25	·07	Festiniog ...	...	·20	·35	·13
Bala ...	·02	·08	·09	Bangor ...	...	·13	·33	·37
Ruthin ...	·27	·10	·07	Carnarvon...	...	·15	·29	·24
Dolgelly ...	·13	·28	·12					

From time to time local epidemics of diphtheria make their appearance in the various districts, some of the low-lying damp valleys being specially liable to them. The bleak damp plain which runs irregularly across the Llyn peninsula had two severe visitations of diphtheria and the death-rate in the Pwllheli district from this ailment is therefore very high. But in the other districts the mortality from diphtheria is distinctly below the average in England and Wales. Scarlet fever prevailed to the largest extent in Flintshire, but is also above the average in the Wrexham and Festiniog Registration areas. The death-rate from typhoid fever was very small; only in Bangor did it exceed the average, whilst in all the other districts it was much below.

HEALTH RESORTS ON THE COAST.

PRESTATYN.

Proceeding westward along the North Welsh coast from Chester, **Prestatyn** is the first health resort which calls for attention. It stands between the sea and the base of the northern termination of the Flintshire hills, but almost at the point where they begin to trend southward to form the eastern boundary of the valley of the Clwyd. Behind it the hills rise to the height of 3,500 feet; in front there is a large stretch of flat land, much of which was covered by the sea at high tides until recent times. To the east this flat land is sandy, but the western portion is damp pasture land. At Prestatyn the coast seems generally rising, and we see the remains of the landing-place and a warehouse in the middle of a flat land, showing that here the water at high tide was once deep enough for cargo boats. Now a series of sand-hills several hundred yards north of these remains to mark the high-water line, and there is evidence that before long the whole of the flat surface between the village of Prestatyn and these sand-hills will be covered by buildings. The town is somewhat irregularly built, and has no attractive features. Except on the south and a slight extent on the east, it has no protection from adjacent hills. Yet it has advantages as a health resort, for the rainfall is very small, not above 24 inches, probably a little less: its exposed position renders it a tone-giving place in the summer, and it has good sands.

The drainage is fairly satisfactory ; it runs into a large covered tank about a mile from the centre of the town, and the overflow from this tank passes into a sewer which enters into a small stream near the sea. There is an arrangement for emptying this tank from time to time by pumping its contents into the sewer which ordinarily receives the overflow. The town receives its water from the reservoir supplying Rhyl. Though there is little frost or snow Prestatyn is not a winter resort, for in winter and early spring it is visited by strong cold winds. It is becoming a popular resort for people from the large towns of the north, but has not many attractions for the fastidious health-seeker.

RHYL.

Four miles west of Prestatyn, in the middle of the level stretch of land in which the valley of the Clwyd terminates seaward, is the town of **Rhyl**, with between 8,000 and 9,000 inhabitants.

It is a well-built town on flat land, free from hill surroundings, exposed to every wind, and has the advantage of sands excellently adapted for walking or safe bathing. The large extent of the sands and the excellent bathing render it a healthy and popular resort in the summer months, and no pains have been spared by the provision of an artificial lake and other means to supply attractions to visitors.

A marked feature in the climatology of Rhyl is the smallness of its rainfall. The following meteorological table (see p. 302) has been abstracted from the annual report of Dr. Eyton Lloyd, the medical officer of health for Rhyl, and kindly placed by him at my disposal. It gives the rainfall and monthly and annual temperature for ten years between 1882 and 1892.

The sandy alluvial soil on which Rhyl is built and the small rainfall, render it a dry place. Rhyl is essentially a summer resort, but the weather is often satisfactory for visitors to the end of the year. In the first three months strong cold winds prevail, but after this and in the summer months the weather is warmer than in other places on the coast, though owing to the exposed situation, Rhyl is not close as well as hot.

The water supply of the town is obtained from a reservoir at

METEOROLOGICAL STATISTICS OF RHYL
FOR THE TEN YEARS 1882-1892 (1890 omitted).

MONTH.	Mean Barometer Pressure.	TEMPERATURE OF AIR.					RAINFALL.	
		Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature.	Mean Humidity.	Rain, Number of Days.	Rainfall in inches.
January	29.93	48.0	37.5	8.6	49.7	84.1	8.1	2.35
February	30.25	47.0	36.2	10.1	42.6	82.6	7.4	1.36
March	29.91	42.5	36.7	9.9	41.4	81.7	9.1	1.46
April	29.78	53.8	40.5	11.1	46.9	77.3	10.8	1.58
May	29.93	58.7	45.6	12.7	52.1	76.5	11.4	1.86
June	30.07	64.5	51.9	12.5	58.3	77.4	9.5	1.83
July	29.70	66.4	53.8	12.5	59.9	77.1	12.0	2.20
August	29.90	67.1	53.3	12.7	60.6	70.2	15.0	2.25
September	29.90	62.0	50.5	12.7	56.4	76.0	12.5	2.32
October	29.81	55.0	44.0	11.8	49.7	77.8	15.0	3.07
November	29.75	50.1	40.3	8.4	45.0	85.1	14.1	2.41
December	29.97	45.9	36.5	9.8	41.1	81.3	12.8	2.35
Annual	29.91	55.1	43.9	11.1	50.7	78.9	137.7	25.04

Llanefydd, eight or nine miles to the south-west of the town. It is not derived from springs, but collected from a watershed; nevertheless it is somewhat hard in character, since it is a limestone district from which it is obtained.

The drainage of Rhyl has been most carefully attended to. The sewers are well ventilated, and at their dead ends are automatic flushing-tanks. The sewage is collected in a reservoir, and from this pumped up into the high-level reservoir, which is discharged twice in twenty-four hours, when the tide begins to ebb, below low-water mark, about a mile to the north-west of the town. It has been ascertained that the currents from the place of discharge are seaward, and that no sewage is brought back towards the coast.

Neither phthisis nor strumous effects are common among the natives, and phthical visitors usually do very well during the summer. Dr. Eyton Lloyd informs me that he rarely sees hæmorrhage in consumptive visitors. For cases of asthma Rhyl is not well suited, but rheumatic patients seem to benefit. Rhyl however is a place for visitors who want to be refreshed by sea-air or sea-bathing rather than an invalid resort. Children seem to benefit markedly from the bracing air of Rhyl, and the place is very well adapted for them since the shore is perfectly safe.

ABERGELE, PENSARN, LLANDULAS.

A few habitations, in some of which accommodation is found for visitors in the summer months, dot the flat coast-land west of Rhyl. Those who take advantage of this accommodation should carefully scrutinize the water supply, which in some cases is derived from surface drainage, and therefore not all that can be desired. Lying on the western side of the valley of the Clwyd, little more than half a mile from the high lands which bound this valley, and about the same distance from the shore, **Abergele** receives protection from the westerly winds, and some shelter too from hills to the south, but is freely exposed to the east and northerly winds.

The warmth of this part in the winter has led to the building of many good residences around it, but Abergele itself is not used as a winter resort. In the summer it is a pleasant place, since it is not closed in with the hills. It has the advantage too of being on the carboniferous limestone which here crops up towards the surface, though in many places it is deeply covered by drift. Directly north of this and close to the sea-shore is **Pensarn**, consisting for the most part of lodging-houses. It is by no means a pretty place, but breezy and tone-giving in the summer. In the winter too, it is bright, and warmer than would be expected from its situation. This is due probably to some protection it receives from the hills to the west and south.

Beyond Abergele, the high lands in which the Denbighshire mountains terminate, approach the shore closely, but at **Llandulas** a break occurs in the hilly coast-line. Here the little river Dulas enters the sea, the valley in which it runs widening out to form a kind of basin looking northward. The rising land on the western side of this basin is wonderfully warm and sunny, protected as it is on the east and west, and to a certain extent on the south. No meteorological records are available, but the vegetation gives evidence of extremely mild winters. In some of the gardens the produce is ready for use almost as early as in the most favoured places in Cornwall. Difficulties in obtaining building land have prevented the development of Llandulas, but a considerable number of residences have been built in recent years, and as Llandulas, besides being warm in the winter, is on the carboniferous

limestone, and is well drained and supplied with water, it will probably become a useful winter health resort.

COLWYN BAY.

In recent years **Colwyn Bay** has become one of the most important winter health resorts of the north. It owes its rapid rise to its exceptional situation.

About three miles beyond Llandulas, Penmaen Head, nearly 300 feet high, projects into the sea. At this point the hills recede from the shore, and then after running parallel to it for nearly two miles again approach it. A belt of land is thus left about a mile wide, which gradually slopes upwards to the base of the semi-circle of hills, ranging from 300 to 600 feet high, which surround it. The whole of this is often known as Colwyn Bay, but the town of this name is situated at the western end of the belt and protected on the south and west by the wooded hills of Bryn Euron; still further to the north-west are the high lands terminating in the Little Orme. Doubtless at one time the bases of the hills constituted the coast-line. The layers of sand, gravel and clay found throughout the area known as Colwyn Bay are drift deposits of the glacier period, and the beds of sand and gravel, sloping upwards as they do from the sea, provide efficient subsoil drainage.

Save where a valley separates the Pwllgyrochan spurs from Bryn Euron, Colwyn Bay is well protected on the west as well as the south, but through this valley a strong current at times blows over the north-western side of the town and its coast continuation northwards to Rhos.

The more distant part of the semi-circle of hills gives protection on the south-east and east, but these winds are rare as compared with those from the west. The chief force of the south-east wind passes over Colwyn Bay and reaches the level of the sea.

To the north and north-east winds it is fully exposed; these however blowing against the high land which partially surrounds the town seem to lose the evil influence they would otherwise have. The whole of the area included in the semi-circle of hills is more or less protected, but a little eastward of the town of Colwyn Bay this protection is less marked, especially where the

valley of Nant-y-Glyn intersects the surrounding range and makes a gap running from south-west to north-east, through which strong air currents drive. Near Penmaen Head is Old Colwyn, which is exposed to the north, but well protected to the east and south-east.

Notwithstanding the protection afforded by surrounding hills, strong winds are frequently felt, especially in the early spring, in this district of Colwyn Bay, and wherever the background of hills is low, the effect of the wind on vegetation is shown by the shape of the trees, which are flattened on the windward side.

A very exact record of the rainfall and temperature has been kept for many years by A. O. Walker, Esq., at Nant-y-Glyn, which is a short distance from the town and 150 feet above the sea, and more recently Dr. Lord of Colwyn Bay has also made a series of meteorological observations in the town itself. I am indebted to these gentlemen for the data from which the meteorological table relating to Colwyn Bay has been prepared:—

MONTHLY AVERAGE OF TEMPERATURE, HUMIDITY AND RAINFALL,
AT NANT-Y-GLYN, COLWYN BAY.

1888-1890.

From the Meteorological Record of A. O. WALKER, Esq., F.L.S., Nant-y-Glyn.

MONTH.	TEMPERATURE.				RAINFALL.		
	Max.	Min.	Mean.	Mean Daily Range.	Number of Inches.	No. of Days.	Humidity.
January	44·9	35·5	40·2	8·7	2·68	16	84·0
February	45·2	36·6	40·9	9·8	2·14	14	78·4
March	47·6	36·5	42·1	12·6	2·07	14	78·8
April	52·7	38·1	45·4	14·3	1·85	13	74·8
May	58·8	43·0	50·9	15·8	2·16	13	71·3
June	64·8	48·5	56·6	15·9	1·88	11	73·7
July	66·3	52·5	59·4	14·8	2·48	15	73·2
August	65·5	50·7	58·1	14·5	3·35	15	77·2
September	62·7	48·1	55·4	14·1	2·45	15	77·3
October	55·1	43·1	49·1	11·4	3·26	18	79·5
November	50·0	39·5	44·7	10·4	3·72	18	81·0
December	44·7	35·2	39·9	10·0	2·67	16	80·7

The following records of sunshine and sunless days in Colwyn is taken from Dr. Lord's paper on Colwyn Bay in the *Medical Chronicle*, July 1896:—

TABLE SHOWING SUNSHINE AND SUNLESS DAYS AT COLWYN BAY, FROM
JANUARY 1894 TO JUNE 1896.

MONTH.	Hours of Sunshine.	Sunless Days.
January	69·3	6·0
February	85·7	5·7
March	118·6	3·0
April	191·8	2·3
May	258·3	0·6
June	239·5	0·6
July	199·5	1·5
August	135·5	2·0
September	197·0	3·0
October	99·5	2·0
November	64·5	7·5
December	44·0	7·5
First Quarter	303·6	14·7
Second Quarter	689·6	3·5
Third Quarter	532·0	6·5
Fourth Quarter	208·0	17·0
Year	1733·2	41·7

Colwyn Bay is a sunny place whether judged by the hours of sunshine or the small number of sunless days. The average annual temperature is slightly lower than either at Llandudno or Rhyl and less than a degree lower than at Torquay. But the lower average is chiefly due to the coolness of the summer months. Nevertheless Colwyn Bay is not a bracing place in summer, because it is within a semi-circle of hills which shelter it from prevailing winds.

Old Colwyn at the eastern extremity of the bay is more cool and bracing, and so too is the village of Rhos, which is adjacent to Colwyn Bay.

The mildness and equability of the climate of Colwyn Bay in the winter months is remarkable. The vegetation gives proof of this mildness. In sheltered parts, as under the Pwllycrochan hill, roses bloom throughout the winter, and the arbutus, the laurustinus and the bay flourish.

In the first quarter of the year the temperature is somewhat higher than at Bournemouth, in the last quarter very slightly lower.

The air is by no means still during the winter months, for though the force of the westerly winds is broken by the sheltering

hills, they are still felt. Winds from the east, north, and north-west are comparatively infrequent, as may be seen from the meteorological table relating to Llandudno.

Colwyn Bay is one of the drier coast health resorts, and the rainfall, 30·7 inches, is higher than at Rhyl, and largest in the fourth quarter of the year. There is free drainage through the sandy soil, and the humidity of the air (77·7) is less than at most other coast health resorts.

During the three years, 1896-8, Dr. Lord has kept a record of the condition of the mist at 9 a.m. During this time there were only nine occasions on which objects a mile away were not visible. On six of these they were visible at half a mile, on two at 200 yards, and on one only at 50-200 yards.

He has supplied me with the following table:—

DAYS PER CENT. OF MIST AT COLWYN BAY AT 9 A.M.
DURING THE YEARS 1896-1898.

	Horizon quite sharp.	Faint haze, objects visible 4 miles and more.	Objects visible 3 to 4 miles.	Objects visible 2 to 3 miles.	Objects visible 1 to 2 miles.
	%	%	%	%	%
4th Quarter	41·3	38·4	11·2	4·7	3·3
1st Quarter	44·1	36·3	10·4	6·3	1·5
2nd Quarter	35·2	49·1	10·3	3·7	1·5
3rd Quarter	46·0	42·4	7·3	3·3	0·7
Year . . .	41·7	41·5	9·8	4·5	1·8

Water Supply and Drainage.—Colwyn Bay has an excellent supply of pure and soft water, which is obtained from Cwlyd Lake, which is situated 1,200 ft. above the sea-level about three miles from Trefriw. The town is also well sewered, the sewers being ventilated where possible by shafts erected against buildings, etc. The outfall is below low-water mark of spring tides.

Prevalence of Disease.—I am indebted to Dr. Lord for most of my information on this subject.

Anæmia and debility are fairly common among the residents, the chief sufferers however being over-worked servants in lodging-houses and shop-assistants.

Phthisis, scrofula and tuberculosis are not common amongst residents. I have already pointed out that the death-rate from phthisis in Colwyn Bay is very low. Bronchitis and catarrh are

not infrequent, especially in children. Dr. Lord attributes this to the distance at which the Board-school is situated from the town, the children often getting wet on the way. Pneumonia and pleurisy are not often seen except during influenza years. Asthma is very uncommon amongst the residents.

Renal diseases.—Acute renal dropsy and chronic albuminuria are very rare; so too are calculus and gravel. Rheumatism and rheumatoid arthritis do not often occur among the residents.

Nervous diseases are probably as common as in other places of the same size. Neuralgia is often seen in residents, very frequently in conjunction with anæmia and carious teeth.

Diseases of the skin.—Eczema is fairly often seen in residents.

Endemic diseases.—Typhoid is uncommon, so too is diarrhoea. Epidemics of scarlet fever occasionally occur as in all other towns. Diphtheria is very rare. A few cases of endemic sore throats are seen every year when the dry hot weather of summer is succeeded by autumnal rains.

Ailments for which Colwyn Bay is suited.—Owing to its mild winters and protected situation, a large number of people suffering from chest affections now resort to Colwyn Bay during the winter months, and since there is abundant sunshine here, and the climate allows patients to be very much in the open air, many cases do very well. Early cases of phthisis with slight signs in one apex, a little expectoration and irritative cough as a rule improve, whether hæmoptysis has occurred or not. Patients with physical signs pointing to fibroid phthisis generally obtain greater relief and often are apparently cured even when much expectoration and signs of cavity are present. A fair proportion of cases of caseous pneumonia with signs of softening, gradually improve. The treatment of patients suffering from phthisis of the florid nervously anxious type is unsatisfactory here as it probably is everywhere. Colwyn Bay suits well the sufferers from bronchitis and catarrh, while convalescents from pneumonia and asthmatic patients also do well. For rheumatoid arthritis, Colwyn Bay is not a good place.

The town and district of Colwyn Bay are rapidly acquiring a large resident population, there being in 1901 nearly 9,000 inhabitants, in addition to a large temporary population. A fair-sized town with streets and shops has now taken the place of what

was until a few years ago a small village. But the place is well fitted for invalids, and some of the houses have been adapted to the wants of phthisical patients by the provision of verandahs looking southward. The hills round Colwyn Bay are well wooded, and there are pleasant walks in many directions, but save near the sea, the land is not level enough for dyspnoeic patients. The higher land in Colwyn is now being rapidly taken up by permanent residences. In the summer Colwyn, though fairly cool, is not bracing like Rhyl and other places fully exposed to the winds, and phthisical patients do not benefit by coming here at this season.

LLANDUDNO.

A little beyond Colwyn the coast-line turns northward, and passes round the promontory on which **Llandudno** is situated. At the north-western extremity of this promontory is an isolated mass of mountain limestone, the Great Orme's Head, six miles in circumference, and rising to a height of 678 feet. It is surrounded by the sea except on the south side, where it slopes rapidly down to the plain, separating the bays of Conway and Llandudno, here about a mile apart. This plain, widest on the Llandudno side, terminates eastward in a ridge of small hills, and connects the two bays of Conway and Llandudno. Along the semilunar bay of Llandudno the land is flat almost as far as the Little Orme, which is two miles distant from the Great Orme. Llandudno largely owes its climatic advantages to the position of the Great Orme, part of it being built under the immediate shelter of this mountain, which on its landward side is incurved. The base of the Great Orme has here yielded admirable sites for houses, which rise one above the other in terraced fashion. In recent years buildings have been extended along as far as Conway Bay.

The western part of Llandudno receives protection from the west, north-west, and south-west winds, and to a certain extent from the north winds, especially where the houses are located on the southern side of a spur which projects eastward, and it is partially protected from the east by the hill ranges ending seaward in the Little Orme.

From the Great Orme the town stretches eastward circling the

bay, and gradually extending less and less deeply backwards towards Conway Bay, until only a fringe of houses facing the sea remains.

The part of Llandudno which is not in proximity to the Great Orme is exposed to the south and south-west as well as to the northerly winds. In the winter months the climate of Llandudno resembles, in its climatic conditions, the most popular resorts on the south coast of England, and the vegetation and meteorological observations show that the part under the immediate shelter of the Great Orme is almost as warm as any place on the south coast.

The geranium requires no special protection in winter, and many plants usually needing artificial warmth in that season thrive in the open air throughout the year.

East of the Little Orme too, is another well-protected area. The rocky mass known by this name, and projecting into the sea, is connected with a ridge of hills running southward by a neck, over which the road passes into the valley beyond. A few hundred yards to the south this ridge sends some projections westward, and in the corner thus formed a large Hydropathic establishment has been erected and many houses built.

The low neck of the Little Orme does not always protect from cold currents coming from the east, yet it affords considerable shelter, and makes these winds much less felt, whilst the hills at right angles to the main ridge give good protection from the south and south-west winds. The Great Orme also exerts a beneficial influence in mitigating the force of the west winds. This part of Llandudno Bay is more exposed to air-currents than that side of Llandudno under the Great Orme, yet the winter here is wonderfully warm, and the garden of a well-known connoisseur in plants and flowers, Mr. Joseph Broome, shows that where protection is given from the winds the flowers grow in the open air as freely as in the warmest parts of the south of England.

In the general account of the climatology of North Wales the meteorological statistics of Llandudno have been drawn upon to illustrate the climatic characteristics of the North Welsh coast, and attention was drawn to the dryness of the air, the high average annual temperature, and the equability and comparative warmth of the winter months. These points are well brought out

LLANDUDNO.
MONTHLY MEANS FOR 1881-1890.

Month.	Mean Barometer. Pressure.	TEMPERATURE OF AIR IN MONTH.						Mean Humidity (p.m.).	WIND. No. of Observations Recorded.						RAIN. Inches.						
		Maximum.	Year.	Minimum.	Year.	Mean of Highest.	Mean of Lowest.		Mean Range.	N.	N.E.	E.	S.E.	S.			S.W.	W.	N.W.		
January	29.94	57.8	1890	14.5	1881	45.6	37.0	8.6	41.3	84	3	3	5	3	6	13	27	2	2	17	2.58
February	29.95	60.0	1887	24.5	1887	45.2	36.8	8.4	40.7	82	4	4	8	5	5	12	17	3	14	185	
March	29.91	67.5	1884	22.5	1886	46.1	36.7	9.4	41.2	79	5	7	7	4	5	9	20	5	15	204	
April	29.88	67.0	1886	27.8	1881	51.0	39.8	11.2	45.4	76	5	9	13	4	3	8	13	5	13	179	
May	29.94	76.9	1888	33.8	1882	57.5	45.2	12.3	51.4	73	4	5	10	4	5	9	18	7	11	195	
June	30.00	81.0	1884	40.4	1881	62.7	50.6	12.1	56.6	74	8	5	5	2	3	8	20	8	12	177	
July	29.90	84.0	1887	42.0	1888	64.8	53.6	11.2	59.2	76	7	2	3	1	5	10	26	8	14	250	
August	29.92	80.8	1884	43.5	1888	64.3	53.3	11.0	58.8	77	5	2	4	1	6	9	26	9	14	256	
September.	29.96	75.1	1890	38.5	1887	61.4	50.9	10.5	56.2	79	5	4	6	4	6	10	19	6	15	217	
October	29.92	72.0	1886	30.6	1881	54.4	45.3	9.1	49.9	80	6	5	7	5	5	9	21	5	17	306	
November.	29.84	62.8	1881	29.0	1887	51.4	41.7	9.7	46.0	82	4	3	6	3	6	10	23	5	18	324	
December	29.90	60.0	1888	20.0	1890	45.5	37.2	8.3	41.4	83	5	5	6	3	5	11	22	5	16	254	

¹ Maximum and Minimum — Absolute Highest and Lowest in Period.

in the accompanying table (p. 311). It will be noticed also in it that the rainfall during the years 1881–1890 amounted to 28·1 inches. In a longer series of years, 1866–1890, it was, however, 31·28 inches, and it seems probable that it does not really differ from that of Colwyn Bay. The average number of rainy days in the ten years is almost identical in the two places. The record of sunshine is not quite so favourable as that of Colwyn Bay for the short time during which a comparison is possible. But the time is too limited for any conclusions to be drawn, and it is possible that the site of observation at Llandudno was not quite so satisfactory.

The subsoil of Llandudno is for the most part gravel and sand. Near the Great Orme's Head the limestone formation prevails, further east are Caradoc Beds. It is possibly largely due to the limestone formation on which Llandudno is built, that the place is so dry.

Drainage and Water Supply.—Rather more than twenty years ago an excellent system of drainage was established at Llandudno, the older one being left for the carriage of surface and subsoil water only. The sewage is discharged into the western (Conway) bay, by an iron pipe below low-water mark. The discharge only takes place during four hours in each ebb and flow of the tide: during the remaining eight the sewage accumulates in what is termed a tank-sewer, the sea-water being prevented from entering by a self-acting valve. The ventilation of the street sewers is well provided for. Llandudno is supplied with very good water from two lakes on the western side of the Conway river, about 13½ miles from the town. The water is soft, and free from organic impurities.

Prevailing Diseases.—Dr. Nicol and Dr. Dalton have been good enough to furnish information with regard to the prevalence of diseases, and the influence of the climate of Llandudno upon patients sent there for treatment. As already pointed out, the death-rate from phthisis is very low; indeed, apart from imported cases, the disease is now rarely met with. There is reason, however, to believe that thirty years ago it was not infrequent. Bronchitis and catarrhs are usually slight in character, and very little pneumonia is seen. Asthma is not common among the natives. Renal diseases are rare, and calculus and gravel practically unknown. Rheumatism and arthritis are not com-

mon, but neuralgia is not infrequently met with, being chiefly dependent on caries of the teeth, which is very prevalent amongst the Welsh people. Diseases of the skin, particularly eczema, are not often seen, and cases of the kind in visitors usually improve. Notwithstanding that the urban sanitary district of Llandudno contains about 9,000 inhabitants, only three deaths from scarlet fever occurred in the five years ending 1897, while during the same period of time there were eight deaths from enteric fever. In 1896 an epidemic of diphtheria prevailed which caused eleven deaths, but there were only three fatal cases during the next four years. In the town of Llandudno itself, diphtheria is very rare. In recent years diarrhoea has been uncommon and slight.

Ailments for which Llandudno is suited.—In both winter and summer Llandudno is well suited for early cases of phthisis, and hæmoptysis is rarely met with. In winter, patients suffering from phthisis and bronchitis find that part of the town which is immediately under the shelter of the Orme's Head most advantageous as a place of residence. Its sheltered position does not interfere with free access of air and there is no closeness, the winds which sweep northward and southward between the two bays preventing this. Unlike many hill-surrounded places it is bracing and breezy even in the summer, and on this account a large number of permanent residents have located themselves in this part. But the well-sheltered area is not extensive, the further the shade of the Great Orme is left the more is the force of the strong air-currents blowing between the two bays felt, and invalids who want to extend their walks often find the wind too strong for them. In the summer however these currents render Llandudno comparatively cool and well adapted for those requiring bracing air. A refreshing wind can be felt on the shore during the greater part of the day, and the coolness of the wind there should be borne in mind by those who are subject to bronchitis or are very susceptible to cold. The majority of asthmatic patients find that Llandudno suits their ailment.

Llandudno possesses many advantages for convalescents. It has good sands for bathing, and there can be no fear about the contamination of the water in the bay with sewage, since none enters it. Those who desire to take exercise on the level can find

abundant opportunities of doing so, for there is plenty of flat land south and east. The road along the bay extends for two miles without any rise: on the other hand, those who desire hill exercise can obtain it on the Great Orme.

The proximity of Llandudno to the chief points of interest in North Wales fills it with visitors during the summer months, but it is worthy of note that it has a large number of visitors during the winter months also, who come to enjoy the bright sunshine and the bracing air and freedom from fog and snow which are marked features of the winter climate of Llandudno.

About two miles south of Llandudno and on the line which connects it with Conway is a small place called **Deganwy**, which is sheltered on the north and east by a small range of hills, and to some extent on the south-west by the high lands of Carnarvonshire. It is pleasantly situated, and in recent years has had many visitors in the summer months.

PENMAENMAWR AND LLANFAIRFECHAN.

Though Conway has a mild climate like other parts of the Welsh coast, and this has led to the erection of many residences round the town, it can hardly be regarded as a health resort. But some four miles to the west, the hills which for the most part line the coast so closely as to leave little more than sufficient space for the railway and the road, recede at Penmaenmawr Point, and leave an area of more or less level land between the bases of the hills and the sea-shore as far as the point where the Penmaenmawr mountain juts into the sea. A spur from Moel Lys almost divides this area into two parts. In the most eastward of these only a few houses for residents have yet been built. But in the western bay is the rapidly increasing health resort of **Penmaenmawr**. The climatic characteristics of this place are dependent on its aspect and the height of the hills which encircle it. It looks north-west, and is exposed to the full force of the winds blowing from this quarter, and from the north. Westward, Penmaenmawr mountain rises to about 1,500 feet; a range from 1,000 to 1,300 feet protects the town on the south; whilst on the east is Moel Lys, another hill 1,100 feet high, with spurs reaching almost to the

sea, and still further eastward Penmaenbach weakens the force of the wind. Owing to the manner in which it is surrounded by hills, Penmaenmawr is warm in the winter. The myrtle may be seen growing out in the open air, and the bay tree flourishes. But the height of the mountains interferes somewhat with the sunshine, and Penmaenmawr has not made way like Colwyn Bay as a winter resort. In the summer, on the other hand, it is a popular bracing health resort. Probably its north aspect favours its tone-giving properties, and there is not sufficient space between sea and mountain to allow of any want of air circulation. The sands are good and give facilities for bathing. The drainage is satisfactory, the sewage entering the sea between Penmaenmawr and Conway, and about a mile and a quarter from the centre of the town. The water supply is mixed, some coming from the mountain, which is good, and some coming from a valley above the town. The latter supply is of doubtful character. The officer of health has advised that the old supply above the town should be discontinued.

Llanfairfechan, which lies at the base of the western spurs of the Penmaenmawr mountains, has a very different position from Penmaenmawr. It is more open and looks westward on the Lavan sands and Anglesey.

Beyond Llanfairfechan the Carnarvonshire mountains do not again reach the coast, and the place has therefore no immediate protection from the western winds, though their full force is broken by the high land on the north of Anglesey. Notwithstanding its open situation, it is warm in winter like the other places on the North Welsh coast, and many visitors frequent it at this season. In the summer its open situation and its exposure to northerly and westerly winds render it a bracing and comparatively cool place.

Exact meteorological observations are wanting, except with regard to rainfall, which is high. Some observations concerning temperature and air pressure are being carried on by Dr. Fagge, but they do not extend over a sufficient length of time to throw light on the meteorology of Llanfairfechan. The place is bright and sunny, and is said by some to be warmer than Penmaenmawr. It is certainly more open, but on the other hand more exposed to the west and south-west winds; hence the high rainfall.

MENAI STRAITS, ANGLESEY.

Whilst in the twenty miles of coast which separate Abergele from Llanfairfechan, there are five health resorts more or less frequented in the winter, there is hardly one to be found further on the Welsh coast until Cardigan Bay is reached. The mild winter climate of Bangor leads, it is true, many to choose it as a place of residence, and the vegetation in the grounds of the houses built on both sides of the Menai Straits, but especially on the Anglesey side, indicates winter mildness. Cold damp winds however not infrequently blow through the Straits, and it is only in favoured sites that there is sufficient protection for winter residents, whilst in the summer there seems to be a lack of that tone-giving influence which makes the north coast so popular.

Anglesey itself has a mild winter climate, but owing to want of protection from the winter winds, it offers few inducements for those who seek winter quarters in the cold season of the year.

There are many places on the coast which offer advantages to those who desire to recruit their health, the largest of these being **Beaumaris**, which is the county town of Anglesey. Sheltered from the west and north-west winds by the high lands in the north of the island, Beaumaris has a mild sunny climate and a south-eastern aspect: consequently in the summer it is less bracing than some of the places which face the north. In winter however snow is rarely seen, and the average temperature is probably high, though no meteorological observations are available. The imperfect protection from strong winds, its eastern aspect, and perhaps too the fact that it is more difficult of access than many other resorts, have prevented any considerable development of the place as a winter resort, for which nevertheless it seems well fitted.

Dr. Grey Edwards informs me that strumous and tuberculous diseases are not common in the Beaumaris district, nor is phthisis frequently met with. His experience leads him to believe that cases of phthisis are usually much benefited by residence here.

Hæmoptysis is not specially noted in visitors suffering from phthisis. Anæmia, albuminuria, calculus and gravel are not

common, nor is there any special prevalence of bronchitis and catarrh.

Dr. Edwards thinks that asthma is not often benefited by residence at Beaumaris, but this ailment is not common amongst the natives of the place. There is an average amount of rheumatic affections and neuralgia, but typhoid fever, scarlet fever, diphtheria and epidemic sore throat are rarely seen.

The town is well drained, the sewage entering the sea below the low-water mark. According to Dr. Edwards, the water supply is very good, coming from a lake on the high ground.

There are many other places on the Anglesey coast which are well adapted for summer health resorts, but they are all in an early state of development. The high lands of the northern part of the island for the most part abut upon the sea, but here and there are charming bays which would long ago have attracted visitors had they been more accessible.

Red Wharf Bay is encircled by low hills, and presents a magnificent area of firm sand. On the eastern side is a small village with somewhat primitive accommodation, admirably situated. Further westward is **Bull Bay**, with an hotel on its south side, capable of much improvement indeed, but well adapted for those who seek quiet but bracing summer quarters. There are likewise a few guest-houses. Still further westward is **Cemmaes Bay**, with a straggling village in which visitors can find fair accommodation. These and other smaller bays, with a fine sea and a background of high land, will no doubt in time attract a large number of visitors during the summer months, but at present they lack many of the requisites for invalids.

The water supply in almost all of them is defective, and the accommodation is inadequate for those accustomed to places less remote from the large centres. In some of the coast villages too, phthisis is very prevalent, as for example at Cemmaes Bay. This seems due to the defective construction of the houses of the inhabitants of these districts, which seem for the most part built with the idea of protection from the winter winds and without any due regard to sanitation.

The western portion of the island has a sparse population, and north of Holyhead affords hardly any accommodation for visitors. **Holy Island** however, on the north part of which Holyhead is

situated, now attracts a considerable number of visitors. Its western and southern shores are indented with small sandy bays, fringed with rocks and presenting great advantages both for boating and bathing.

At **Rhoscolyn** and one or two other places there are small hotels, but accommodation for visitors is chiefly provided in the farm-houses, some twenty of which take visitors in the summer months.

The air of this locality is particularly bracing, for the district is very open and exposed to the full force of the west winds.

The southern side of Anglesey differs entirely in character from the northern,—it is flat and sandy. At **Rhosnegir** a number of houses have recently been built for visitors, and the broad extent of dry sand here, together with the openness of the country round, will probably lead to the rapid development of the place as a health resort.

Aberffraw is a small village with somewhat primitive accommodation, which only those who like extreme quietude will care for, whilst the village of Malldraeth presents no attractions and can hardly be regarded as a health resort.

LLEYN PENINSULA.

As stated in the sketch of the climatic topography of North Wales, no winter health resort has been developed on the western side of the Lleyn peninsula. The coast is indeed little frequented even in summer, yet for twelve miles south of Carnarvon it has a fine beach.

At Llandwrog, six miles from Carnarvon, there is a hotel, whilst Clynngog receives visitors who desire good but unconventional sea-bathing. But a little further south the coast becomes rocky, and continues so until **Nevin** is reached. This small town, though close to the sea, has no outlook upon it, and has evidently not been arranged for the accommodation of visitors. But adjacent to it is a fine bay with sandy shores, and a background of low cliffs, whilst further on is a second bay on which an adjunct to Nevin—Morfa Nevin—has been built. Both to this place and to Nevin many visitors go in the summer, for though there is much

wind in these parts and sometimes mists, the air is very bracing. Round Nevin too there are many houses well adapted for summer quarters.

Dr. Evan Hughes, who has long practised at Nevin, says that among the inhabitants there is much less scrofula and tubercular disease than in former years. Hæmoptysis and catarrh are very common in the winter and spring, and asthma is not infrequent. Some of the families in Nevin seem specially predisposed to this ailment. Nevin does not seem well adapted for actual invalids, but is a charming place for convalescents.

One or two points however should be borne in mind by those who go there. The drainage of the town itself is imperfect, and though it has a primitive arrangement for water supply, viz. a well in the town itself, and this water supply is reported to be good, yet many of the houses let to visitors have both bad sanitary arrangements and a bad water supply.

ABERSOCH.

Some of the little coast villages on the south of the Llyn peninsula are occasionally visited by tourists, but none of them are of value to invalids till we come to **Abersoch** on Cardigan Bay.

This small place gives opportunity for good bathing in the summer, and in the winter is said to be very warm owing to the protection it receives from the west and north. Many houses are being built there, with the idea that in a short time it will be found advantageous for phthisical patients. Before however it receives any large population, both water supply and drainage must receive more careful attention than they have done so far.

PWLLHELI AND LLANBEDROG.

Pwllheli on the south side of the Llyn peninsula and on the northern part of Tremadoc Bay, is a market town, which has only in recent years attracted much attention, and until lately the construction of the town has not borne much relation to the requirements of health-seeking visitors. Naturally however it has a very advantageous position.

With a southern aspect seaward, it is encircled by a series of small hills on the west, north and north-east, which rise immediately behind the town, and are from 100 to 200 feet high. Further northward these hills terminate in the high range of the Carnarvonshire mountains, which together with those of Merionethshire give some protection to all the northern part of Tremadoc Bay.

In consequence of its situation Pwllheli is warm in the winter, and sub-tropical plants grow there freely. It is not so fortunately situated with regard to the sea-shore, for a large area of mud and sand, constituting the harbour and only covered at high tide, lies in front of the town.

In recent years an embankment and causeway have been made across the lower part of the harbour to reach the fine beach beyond. On this beach a new town is in course of erection, with all the accessories of an important watering-place, fine hotels, esplanades, etc. This new part of Pwllheli is very open, and has a splendid beach, but it is not sheltered from the winds after the manner of the older town. It only receives protection from the more distant mountains.

Dr. Hughes informs me that amongst the inhabitants of Pwllheli liver troubles and gastro-intestinal disturbances are common, and scrofula and tubercular diseases prevail in some families, but he thinks the tendency to these diseases is decreasing. Bronchitis and catarrh are common, but phthisis is not unduly prevalent. Anæmia, rheumatism, neuralgia, albuminuria and renal disease, and skin diseases are not prevalent. Epidemics of diphtheria and scarlatina have occurred at long intervals. The town is very free from typhoid fever, although a few cases occur from time to time.

The sewage of Pwllheli itself is discharged near the Gimlet Rock quite away from the beach. The new part of Pwllheli on the south-west of the town has a separate drainage system.

There can be no doubt that the condition of the harbour is at present a drawback to the place: the large expanse of mud and sand exposed at low tide gives rise to objectionable smells which are often unpleasantly perceptible on the causeway leading to the new part of Pwllheli. The question of dredging the harbour for the removal of this discomfort is now under consideration. This must certainly be taken in hand if the place is to occupy the

position of a health resort to which its climatic advantages entitle it.

Pwllheli will prove specially advantageous for those who are benefited by a mild winter climate, as for example sufferers from bronchitis, but proof has yet to be given that it is specially useful in phthisis. In the summer the new part of the town is a bracing, tone-giving health resort, the sands are dry and admirable for bathing.

Llanbedrog, about four miles from Pwllheli, is a small place which possesses many climatic advantages. It lies immediately under the great hill of Llanbedrog which abuts upon the sea, and is being rapidly developed as a health resort. It is said to be somewhat relaxing, and may be so in some of the more sheltered parts, but some of the many fine sites which abound in this district are splendidly placed and must be very bracing.

CRICCIETH.

Whilst Pwllheli is at the western end of the northern shores of Tremadoc Bay, **Criccieth** is at the eastern. It has many climatic features in common with Pwllheli, for it has the shelter of the same semi-circle of distant hills. But instead of being immediately surrounded by low hills, it stands at the termination of a prolongation of a hill. The town looks south. Eastward and westward there is no immediate protection, but to the north are hills gradually rising until the main Carnarvonshire range is reached. On account of its open position and its sandy beach on each side of the Castle Rock, Criccieth has long been a favourite summer health resort, but few visitors remain through the colder months although the winter is mild.

According to the records kept by Dr. Roberts of Talavor, the average rainfall is high—nearly 40 inches.

The inhabitants do not suffer specially from scrofula and tuberculous diseases, although these are seen with ordinary frequency. Phthisis has decreased in frequency of late; hæmoptysis occurs often at times. Bronchitis and catarrh are not infrequent, and asthma is rather common, but some asthmatic patients derive benefit from a residence at Criccieth. Renal diseases are not

often met with. Rheumatism is the prevailing ailment, and rheumatoid arthritis is very common among the working-classes. Typhoid fever is rarely seen, and diphtheria is almost entirely absent.

The drainage of Crickieth is satisfactory; the sewage enters the sea by pipes on each side of the Castle Rock, one discharging 600 yards to the west, and the other 300 to the east of it; the termination of the pipes is usually below the low-water mark, but at very low tide they become exposed, and it is proposed to carry them further out.

The water supply of Crickieth is not good; it comes from an old slate-quarry, the water of which is derived from surface drainage. It contains a good deal of organic matter, and tends to act upon lead pipes.

Crickieth is a fairly bracing place in the summer months; the south-west winds are the prevailing ones, and the place is fully exposed to them. May, June and July are the finest months in the year. August is often wet.

PORTMADOC.

Beyond Crickieth the coast trends southward, and a wide space of flat land separates the hills of Carnarvonshire from those of Merionethshire, through which runs the Traethbach with a wide tract of sand on each side of it. At one time the sea no doubt covered the whole of the flat land, and indeed at the beginning of the nineteenth century an arm extended inland as far as Aberglaslyn, but at this time a gentleman named Madoc reclaimed from it the whole of this arm, and he has given his name to **Portmadoc**, the chief harbour of this part of the coast.

In recent years many visitors have come here for the summer, for the place is very healthy, and has some pretty cliffs overlooking the sea. In ancient times the natives of the flat land were very subject to intermittent fever, and on the land reclaimed by Mr. Madoc malaria was especially common; of late however it has ceased to appear. Phthisis seems by no means infrequent. Dr. Jones Morris informs me that one-tenth of the total number of deaths is from phthisis. According to Dr. L. Griffiths, cancer is

very common in this district, there being hardly a farm, he says, in which he has not attended a case of this disease.

There is a considerable quantity of rain at Portmadoc, the fall being distinctly larger than at Criccieth.

A short distance from Portmadoc in the direction of Criccieth, is a small place called **Borth**, which consists of a series of lodging-houses. The shore however here is unsatisfactory. There is a spring of fresh-water on the shore, and in consequence the seaweed decomposes, giving rise to unpleasant odours.

HARLECH.

At **Harlech** the Merionethshire mountains approach the coast, and the town itself stands on a hill 200 feet high, the base of which terminates half a mile from the sea. It is not adapted for invalids, and those who visit it for other purposes should bear in mind that the drainage and water supply of the place have not, up to the present time, been properly attended to.

At **Llanbedr** and **Dyffryn**, south of Harlech, a few visitors are to be found each summer. Both these villages are situated some little distance from the shore.

BARMOUTH.

Barmouth is situated at the base of some hills which fill up the angle formed by the estuary of the Mawddach and the sea, rising rapidly on the north and east of the town, and attaining a height of between 800 and 900 ft. The greater part of Barmouth faces westward, but some portion of it looks towards the estuary and has a southern aspect; it is completely protected towards the north and east, but it is fully exposed to the west and south-west winds. These however are less felt than at most places on this coast, for they blow against the high land behind the town. Barmouth therefore though a bracing, tone-giving place in virtue of its exposed situation, has some of the advantages which belong to more sheltered spots, and the vegetation gives evidence of warmth of climate and protection from cold air-currents. The myrtle

grows freely in the open air, and sub-tropical plants may be seen in many of the gardens. The average temperature for the year is high, and the spring and autumn months are remarkable for their warmth. Dr. Lloyd says that April, May and June are the best months of the year, but the winter also is mild. Owing to the influence of the adjacent hills precipitation of the watery vapour from the air-currents coming from the west and south-west, takes place, and the rainfall consequently is rather heavy. The snowfall on the other hand is slight.

Tubercular disease and phthisis are, according to Dr. Hughes, rare in the inhabitants of Barmouth, but they are not uncommon in the neighbouring country. Dr. Hughes says that in cases of phthisis living at Barmouth he has not observed any tendency to hæmoptysis. In the winter, bronchitis and catarrh occur with average frequency, and asthma is met with occasionally; rheumatic affections are not often seen, and typhoid fever is extremely rare. Dr. Hughes, who has been in practice in Barmouth for thirty years, only remembers one epidemic of diphtheria.

The drainage of Barmouth is in a very satisfactory condition, the sewage entering the sea near the island to the left of the town below low-water mark. The water supply is perfectly satisfactory.

Barmouth is extremely well adapted for convalescents who require a mild as well as a bracing air. It is very suitable for bronchitic cases in the early spring and late autumn, and is well adapted for the residence of phthysical cases, for there are many sunny and protected spots in and around the town, where patients can spend the whole day in the open air. The number spending the winter at Barmouth is not as yet very large, but it seems probable that before long it will become utilized for a winter resort to a greater extent than at present.

TOWYN.

Towyn is a complete contrast to Barmouth so far as climatic situation is concerned. Instead of the hills being close to the sea, as at Barmouth, they terminate nearly two miles from the coast, and Towyn lies on the flat land half-way between the hills and the shore. The town itself is not specially adapted for

invalids, but facing the sea there are excellent arrangements for visitors in the shape of hotels, lodging-houses, promenades, etc. The distant hills around the district in which Towyn is situated no doubt exert some slight protective influence against the north and east winds, but otherwise the place is fully exposed to air-currents from every quarter. It has therefore not the mildness of Barmouth and is less adapted for the early stages of convalescence.

ABERDOVEY.

South of Towyn the Merionethshire mountains gradually approach the coast, and at the point where the estuary of the Dovey opens out, there is but little space between them and the beach. Thence they run eastward, bordering the estuary, rising almost directly from the coast, and quickly attaining a height of from 500 to 600 feet. About a mile eastward of the opening of the estuary is the town of **Aberdovey**. This looks southward upon the estuary and the flat land of Cardiganshire beyond.

Fully exposed to the south and south-west, Aberdovey is well sheltered from every other quarter. To the north and north-west are the high hills of Merionethshire. These send down spurs so far as to give partial protection also from the west. On the east the Montgomeryshire hills give shelter. As the result therefore of this protection from every quarter except the south and south-west, Aberdovey has a climate of extraordinary mildness.

Dr. Kershaw of Royton tells me that many sub-tropical fruits and flowers flourish in the grounds round Aberdovey. The fig may be seen not uncommonly fruiting in the open air. Meteorological methods have been commenced, but they have not been kept sufficiently long to allow the publication of the results so far obtained, but there is reason to believe that Aberdovey will be found one of the warmest places on the Welsh coast in the autumn, winter and spring. Snow rarely falls here.

Aberdovey has not at present many visitors in search of health, but judging from the statements of those who reside here, it affords during the early spring months an admirable climate for those who require warmth, and desire to spend a large portion of their time in the open air.

The drainage of the town is good ; the sewage being discharged into the middle of the stream. A new water supply has recently been acquired by the town which is everything that can be desired.

The months of July and August are very warm, too warm indeed for the comfort of some invalids, but February, March, April and May, and likewise September and October are extremely pleasant months at Aberdovey, which will probably be found one of the best places on the coast of Great Britain for bronchitic patients and others who require a mild climate in the spring and autumn months.

INLAND RESORTS.

Though the coast abounds with excellent places for convalescents, there are very few inland places to which invalids can go with advantage either in winter or summer. Doubtless there are here and there spots all over the country where some benefit could be derived, but the inland part of Wales is adapted for the pleasure-seeker and the tourist rather than the invalid.

Bettws-y-coed is a place occasionally resorted to, but it is too much surrounded by hills to prove satisfactory where a bracing tonic air is desired.

Llangollen is a favourite summer resting-place and many residences have been built around it, but the drainage and water supply of Llangollen itself leave much to be desired. The rainfall is high, and the valley itself is somewhat close, but on the hills which rise from the vale convalescents may in summer obtain much benefit.

The only other place inland which requires special notice is **Trefriw** in the valley of the Conway. This little place is advantageously situated. It looks eastward, and rising behind it are the Dolgarrig mountains, while to the south and south-east are the Gwydyr hills and woods. As the place is only about seven miles from the sea, there is at Trefriw a combination of mountain and sea air, which many find beneficial. All around the place there are beautiful sites for houses, and many are now being built. The

drawbacks to the place are its eastern aspect and the low-lying land in the valley of the Conway.

The rainfall too is somewhat heavy, for into the valley of the Conway there are one or two openings from the west and south-west, through which the rainy winds from the south-west enter. The rainfall at Trefriw has not, as far as I know, been ascertained.

Trefriw has the advantage of a strong iron mineral water which is really derived from a quarry about half a mile from the town. There are two springs; both contain large quantities of proto-sulphate of iron and sulphates of alumina, with a small quantity of sulphate of magnesia and lime. The following is the analysis which has been given by Dr. Hassall of the two waters, the figures representing grains per imperial gallon (70,000 grains), but there is some reason to believe that the water varies much in composition from time to time:—

ANALYSIS OF THE FERRUGINOUS SPRINGS AT TREFRIW.

				No. 1. Temperature at Source, 48° F.	No. 2. Temperature at Source, 50° F.
Protoxide of iron	...	...	...	180·85	81·11
Alumina	...	...	...	14·73	10·20
Magnesia	...	...	...	5·30	6·94
Soda	...	...	...	1·44	2·38
Lime	...	...	...	11·42	13·70
Manganese	...	...	...	traces	traces
Sulphuric acid	...	...	...	263·20	149·83
Chlorine	...	...	...	0·76	0·53
Silica	...	...	...	10·43	11·74
				<u>488·13</u>	<u>276·43</u>

Trefriw is fairly warm in winter, very little snow falling here, and visitors come here throughout the cold months of the year. The climate indeed is so mild that geraniums are left all the winter in the open air.

The water supply is of a mixed character, that for the village itself comes from the Llanrwst service, and this is derived from a stream flowing from Lake Crafnant, but it is taken too low down the stream to be satisfactory. The water supply for Llanrwst ought to come from Lake Crafnant itself, and no doubt will do so in time as the lake is the property of Llanrwst.

The large hotel at Trefriw has its own supply of water from a spring above the hotel, but there is also a service from the Llanrwst supply. In the summer Trefriw is often resorted to partly on

account of its bracing air and partly by those who desire a chalybeate course.

Notwithstanding the large amount of sulphate of alumina which the water contains, it seems to agree well with those who take it, and patients suffering from chlorosis and forms of debility accompanied by anæmia seem to derive considerable benefit from these waters. There are some baths at Trefriw, but they are of a somewhat rudimentary kind.

Although at the present time in the inland parts of North Wales there are very few places adapted for the reception of invalids, there can be no doubt that, especially in the eastern portion of the Principality, there are many districts well suited for health resorts. On each side of the wide **Valley of the Clwyd** are to be found sunny and bracing sites which will no doubt at some time be taken advantage of. On the Denbighshire side the rainfall is heavier than on the Flintshire side, and the plateau in the centre of Flintshire between Prestatyn and Caerwys seems to me to offer special advantages for the tonic treatment of convalescents, and probably for sanatoria for phthisis. It will be noted that the rainfall throughout this district is small: even at Halkyn, which is nearly 900 feet above the sea, it is only 31 inches. Then again this part of Flintshire is on the carboniferous limestone, a formation which gives every opportunity for the drainage of the subsoil water, and owing to the configuration of the land many areas can be found in which there is protection from cold winds and abundant sunshine. Meteorological observations however are at present wanting here as in so many other parts of Wales.

In conclusion, I have to express my thanks to the many friends who have assisted me by the statistics and information with which they have supplied me.

THE CLIMATE OF SOUTH WALES

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SOUTH WALES lies between 3° and $5^{\circ} 30'$ W. longitude, and $51^{\circ} 20'$ and $52^{\circ} 28'$ N. latitude, and includes the counties of Glamorganshire, Brecknockshire, Carmarthenshire, Pembrokeshire, and Cardiganshire. The population is partly agricultural and partly sea-faring, but chiefly connected with mining industry and metallurgy, for here lies the great Welsh coal-basin, which supplies the famous anthracite coal, used for steamers and exported all over the world; while in addition South Wales is a great centre of copper, silver, lead, and iron smelting.

It is peopled by an energetic, industrious race, still speaking an ancient Gaelic tongue, and remarkable for their love of music, and their strong attachment to their history and traditions, being very jealous of interference with their customs and habits.

South Wales offers great variety of scenery. Mountains rising to considerable height and grandeur, wild moors, rocky glens, extensive woods and smiling valleys, with broad rivers and rushing torrents, as well as a picturesque coast-line, prevent any charge of monotony. This district is as a whole too extensive to treat of in this Report, and our description will be limited to the coast-line and its health resorts, from Aberystwith on the north to the banks of the Rhymney on the east, which is the boundary of Wales and England.

The coast-line is indented and irregular, partly flat, but mainly rocky and hilly. It runs in a westerly direction, with the indentations of Swansea and Carmarthen Bays, to St. Gowan's

Head and Linney Head, and then turns northwards to St. Ann's Head, the northern portal of Milford Haven, and later on curves round in St. Bride's Bay to the most westerly point, viz. St. David's Head. It then passes in a north-easterly direction by Strumble Head and Fishguard Bay to Aberystwith, forming the shore of Cardigan Bay. Numerous rocky islands lie off the coast, of which the principal are the Flat and Steep Holms opposite Lavernock Point, Glamorganshire: Caldy Island and St. Catherine's and St. Margaret's off Tenby; Skomer and Skokholm and Ramsey Islands in St. Bride's Bay. The coast, extending over a line of 300 miles, presents the fine peninsulas of Gower and St. David's, in addition to Swansea, Carmarthen and St. Bride's Bay, and includes the splendid harbour of Milford Haven.

It is washed by the Bristol Channel to the south, measuring not more than $8\frac{1}{2}$ miles in width at Lavernock Point, opposite Cardiff, but widening out to 75 miles opposite St. Gowan's; and on the west by St. George's Channel, 130 miles of which separate it from the nearest point on the Irish coast. The most important element in the waters which lave its shores is the presence of the Gulf Stream, the currents of which not only pass up St. George's Channel, and give Fishguard and other places their remarkably mild climate, but also enter the Bristol Channel, and mitigate the harshness of winter on both coasts, enabling Ilfracombe to surpass Torquay in winter temperature, and converting Tenby into a winter shelter for invalids. But more will be said on this point further on.

The configuration of South Wales is made up of groups of mountains running in various directions, and separated by small rivers emptying into the Bristol and the Irish Channels.

Beginning from the east we have the group of the Black Mountains with the Blorenge, Pencader, Pen-carreg-calch, the Sugar Loaf, the Brecon Beacons (rising to 2,910 feet), and the Carmarthenshire Beacons (2,598 feet). From these run down sundry minor ridges towards the Channel, and from these ranges descend to the Bristol Channel the Usk, the Ebbw, the Rhymney, the Taff with its tributaries, the Rhondda, the Cynon, also the Llynfi, Ogmore, Afon, Neath, Tawe, Loughor and Gwendraeth rivers.

Westward, and rather to the north of this group of mountains, is a chain reaching its highest points in Mount Tregaron (1,754

feet), and Craig Twrch, from which the Towy and Teifi take their origin, the Towy flowing past Llandovery and Llandeilo to Carmarthen to discharge its waters into Carmarthen Bay, and the Teifi pursuing a westerly direction to Cardigan Bay.

This range is separated from the Plinlimmon mountains on the north-east, by the Ystwyth river, which, joining the Rheidol, falls into Cardigan Bay at Aberystwith. There is also a chain of hills dividing the county of Pembroke into two parts and running east and west. This rises to 1,754 feet in the Preseley mountains. Thus the district of South Wales may be summed up as a distinctly mountainous country, intersected by rivers and valleys, with a highly indented coast-line, a large proportion of which is exposed to the influence of the Gulf Stream and the south-west winds, giving rise to a mild and somewhat moist climate.

Geology.—The geology of South Wales has been largely studied by Murchison, De la Beche, Etheridge and others, and presents features of great interest. The following is a brief outline of some of the principal groups of rocks, and is chiefly taken from the admirable section in Murray's *Handbook for South Wales*.

1. The Lias is found chiefly in the Vale of Glamorgan, and extends from near Cardiff to Pyle, where it reposes on the Triassic beds. From the mouth of the Ogmore the Lias is found resting on upturned and disturbed carboniferous limestone, and again near Southerndown and Dunraven; in the latter place the limestone showing a very remarkable upheaval and stratification.

2. New Red Sandstone is to be found under the Lias at Penarth Head in the neighbourhood of Llandaff and Pyle, where it is largely used for building stone.

3. The Dolomitic or Permian rocks generally occupy the slopes of the mountain limestone hills in Glamorganshire, between Llandaff and Kenfig Point.

4. The coal measures of South Wales are most extensive. The coal-basin is in the shape of a pear with the smaller end towards the west, its greatest length being from Pontypool to Kidwelly, 70 miles, and its greatest breadth 25 miles, from Merthyr to Cardiff. The basin is bounded on the north, east, north-west and west by a tolerably uniform belt of mountain limestone and millstone grit and on the south by the Bristol Channel,

under which the coal measures run, and probably join the Bristol coal-field.

The coal-seam is thickest near Neath, where the lowest strata are 700 fathoms below the outcrop of the upper ones. The upper coal measures in Glamorganshire and Monmouthshire comprise the bituminous coal used for domestic, cooking and gas purposes, while the lower measures furnish the smokeless steam coal of South Wales, the first in quality for maritime purposes in the world.

A second, and far narrower coal-field is that of Pembrokeshire, which may be connected with the Glamorganshire one by seams passing under Carmarthen Bay. It runs east and west, bisecting Pembrokeshire, and is limited on the south by the Red Sandstone, on the north by the Silurian series, and a thin layer of mountain limestone. The coal is wholly anthracitic.

5. The mountain limestone section is a comparatively thin one, and on the north extends from the Bloreng mountains near Abergavenny in a nearly straight line to Llandeilo, where it bears off south-west to the coast at Kidwelly, and is of an average thickness of 500 feet. It is well seen near Bridgend, and forms the heights of Newton Down. Proceeding westward it increases in thickness and forms the grand cliffs of the Mumbles and Gower. Finally it re-appears in Pembrokeshire, where two narrow bands come into connection with the coal-field, and a third, mingling with the Old Red Sandstone, forms the splendid coast range of St. Gowan's Head and the Stack Rocks.

6. The millstone grit overlies the mountain limestone, and produces a table-land with a southerly inclination from which most of the rivers of the coal-fields take their rise to flow south to the Bristol Channel. The juncture of the millstone grit with the mountain limestone is marked by a quartzose conglomerate, locally called pudding-stone.

7. The Old Red Sandstone, immortalized by Hugh Miller, occupies a considerable area in South Wales and appears in Brecknockshire, the southern part of Carmarthenshire, and in Pembrokeshire, where it is intermingled with the mountain limestone and the coal-beds. There has been a large amount of denudation in the eastern part of the tract; the softer marls have

been worn away, leaving the upper and harder beds of conglomerate comparatively untouched, and standing out in marked prominence.

8. The Silurian rocks are also extensively met with, and in Carmarthenshire and Pembrokeshire are found to the north of the Old Red Sandstone and coal measures. These are divided into upper and lower Silurian, and subdivided into Tilestones, upper and lower Ludlow rocks, Wenlock limestone, Llandovery rocks, and Caradoc and Llandeilo formations. The Silurian district stretches over the whole of Cardiganshire and the northern division of Pembrokeshire and Carmarthenshire, and the fine masses of St. David's and Strumble Heads belong to this series.

Effects of Ocean Currents on Climate.—The climate of the South Wales coast-line is the same as that of the Bristol Channel, and like that of the opposite Devonshire and Somersetshire coast dominated by the Gulf Stream influence. A portion of this, called Rennel's Current, passing up St. George's Channel washes the coast of Pembrokeshire, Cardiganshire, Carnarvonshire and Anglesea; it further sends an offshoot up the Bristol Channel distributing its influence to each shore, moderating the cold of winter and the warmth of summer, and adding largely to the rainfall.

The proofs of the presence of the Gulf Stream are as manifest on the coast of Pembrokeshire as on the shores of Cornwall. Gulf-weed, cocoa-nut fibre, tropical wood and seeds are washed up at Tenby, on Caldy Island and in Milford Haven.

The mildness of the climate of the whole of this region is seen in the great luxuriance of the vegetation. Myrtles, laurels of different kinds, and fuchsias flourish out of doors all the year round in sheltered nooks, and at Fishguard, palms, camellias and Japanese medlars live in the open air. What is most striking is the luxuriant growth of evergreen shrubs, and pruning is necessitated in well-kept gardens. There is however one natural corrective of over-luxuriant growth, and that is the boisterous south-wester, which prevails frequently and is very powerful and penetrating. Its track may be traced by the shorn look of the ivy and creepers on the walls of buildings exposed to its blast, by the damp and mossy appearance of masonry on that side, and by

the covering of slates with which the prudent Welshman encases the walls open to its fury.

In the subjoined table, based on the map of the *Meteorological Atlas of the British Islands*,¹ I have arranged the sea temperatures of the Irish, Welsh and Cornish coasts.

TABLE SHOWING MEAN TEMPERATURE OF THE SEA SURFACE OFF THE COASTS OF IRELAND, WALES AND CORNWALL.

MEAN TEMPERATURE OF SEA SURFACE.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
<i>East Coast of Ireland.</i>													
Dunst's Rock	47	47	48	49	52	56	57	60	58	56	52	49	52
Coningbeg	48	48	47	48	51	54	57	59	58	56	53	50	52
Intermediate stations (mean of 2)	46	45	46	48	51	55	57	58	59	56	50	47	51
Kish (2 stations) . . .	45	45	45	47	51	55	58	59	58	56	49	47	51
<i>West Coast of Wales.</i>													
Helwick	44	43	45	47	51	55	60	61	60	56	51	47	52
St. Ann's Head	46	46	45	47	51	55	58	60	60	57	52	48	52
Cardigan Bay	46	46	46	46	49	53	57	57	58	56	53	49	51
Carmarvon Bay	46	45	45	46	49	52	55	57	58	55	52	48	51
Holyhead	44	44	44	46	49	55	59	60	59	56	50	47	48
<i>Coast of Cornwall and Scilly Isles.</i>													
Scilly	49	49	49	51	54	57	60	61	59	56	52	51	54
Penzance	46	47	47	49	52	54	56	59	60	57	51	49	53
Truro	49	48	47	48	52	55	58	61	59	57	54	50	53
Padstow	44	46	48	50	54	58	61	62	60	55	51	47	53

Comparing the south-east coast of Ireland and the south-west of Wales, *i.e.* the coasts of Carmarthenshire, Pembrokeshire, and Cardiganshire, it would appear that the water of the Channel off the Irish coast is slightly warmer in winter and slightly cooler in summer than off the Welsh coast. Thus in October and November the two coasts are about the same in temperature, but in December the Irish is about 2° Fahr. higher than the Welsh coast. In January the difference is still marked between the water off Pembrokeshire and that off the south-east of Ireland, though there is hardly any difference between the two coasts of St. George's Channel opposite Dublin and Holyhead. The marked contrast between the Pembrokeshire and Cork coasts, amounting even to 3° Fahr., at times, is continued through February, March and April. In May the Irish coast is still the warmer, but in June the two nearly approximate, and in July

¹ Issued by the Meteorological Office, 1883.

ISOTHERMS SHEWING THE MEAN TEMPERATURE OF THE BRITISH ISLES (After Dr Buchan)



Based upon the observations made during the 40 Years, 1856 - 1895.

London: Macmillan & Co. Ltd

Standard Geographical Names London

the Welsh coast is decidedly the warmer, the Irish coast showing greater coolness and equability. In August and September the Welsh coast is the highest by from 1° to 2° , but in October, as already stated, there is very little difference.

Comparing the Welsh coast temperatures with those of the water off the Cornish coast in winter and summer, we find the warmth is far greater on the Cornish, amounting in winter to from 3° to 5° Fahr., and the nearer the Gulf Stream the greater the contrast between the two; Scilly and Penzance being far warmer than St. Ann's Head and Helwick. In the summer the difference is less marked, though it exists.

Meteorology of South Wales.

Mean Temperature.—The isotherms of January (see diagrams) show the most westerly portions of the Welsh coast to be warmest, as might be expected, for the isotherm of 43° Fahr. just skirts the extreme west of Pembrokeshire, passing through Tenby and Newport and running up the coast of Ireland, while the isotherm of 42° Fahr. runs perpendicularly from Carmarthen upwards through Cardigan to Anglesea. The lines are much the same in February. In March they are slanting, while in April they have become horizontal, and a mean temperature of $47^{\circ}\cdot7$ Fahr. seems to be the figure of the coast. After this date the temperature rises with the usual increase of the sun's power, but in June we see the cooling effect of the sea in the coast mean temperature being at least 1° Fahr., and in July 2° Fahr. lower than inland, this continuing more or less till October, when with the winter season the state of things is reversed, and the coast-line becomes 1° to 2° Fahr. warmer than is the case inland. This again is more marked in November and December, when the difference in favour of the coast amounts to about 4° Fahr.

One point that the isothermal map shows distinctly is that any influence that the Gulf Stream may have on the coast of Pembrokeshire and Carmarthenshire nearly disappears in the Gloucestershire part of the Bristol Channel; for in the middle of winter the water over the English and Welsh fishing-grounds

is 5° lower than on the Welsh coast, and it is probable that the large body of water poured in by the Severn and the extensive evaporation which takes place when the tide runs out in this great estuary, tends to lower the temperature of the water and also that of the superincumbent air.

It will be gathered from what has been said that the South Wales climate is very moderate and mild, neither very severe in winter, nor excessively hot in summer, both extremes being tempered by the sea influence. The mean annual temperature of the coast, taking St. David's as about the average, is 49·1 Fahr., Aberystwith giving 51° Fahr., and Carmarthen and Cardiff, as might be foretold from their inland position, yielding the lower figure of 48·8. The first quarter's mean (January, February and March) appears to be, for St. David's and Aberystwith about 41° Fahr., less than the Cornish winter mean, but nearly two degrees warmer than Margate or Ramsgate on the eastern coast. (See Tables, Vol. I.) The mean of the second quarter (April, May and June) is for St. David's 50·6 Fahr.; for Aberystwith 51·5 Fahr., not greatly differing from that of Margate and Ramsgate. For the third quarter (July, August and September) 57·4 for St. David's, 62·4 Fahr. for Aberystwith, and 59·9 Fahr. for Carmarthen, and cooler still for St. Ann's Head (52·2 Fahr.). Margate (60° Fahr.) and Ramsgate (60·3 Fahr.) are some degrees warmer than any of the above, except Aberystwith. The fourth quarter (October, November and December) gives almost identical means for St. David's and Aberystwith (46·6 Fahr.), a slightly higher one for St. Ann's (47·3 Fahr.), and a much lower for Carmarthen, 41·4 Fahr., while here both Margate and Ramsgate show lower records, 45° Fahr. and 44·9 Fahr., than St. David's and Aberystwith.

These records all point to the great influence of the sea and Gulf Stream on the Welsh shore in lowering the summer heat and preventing the fall of temperature in the early winter. The comparison with the eastern British shore only accentuates the contrast.

Maxima and Minima.—These also show the influence of the sea and its currents in tempering the extremes, for at St. David's, St. Ann's Head and Aberystwith, during the ten years 1881–1890, the maximum only reached 80° once (viz. at St. Ann's) and

Map Showing

THE

RAINFALL STATIONS

on the

SOUTH WALES COAST

Castle Grounds

ABERYRON 38
Dulacorn

CARDIGAN 38
Llanidloes
Castle M. Gwyn 44

48 The Castle
NEWPORT

TROSVAN 40
Hyd Lewis

LLANHAUN 41

ST DAVIDS 38
SALA 35
PEN-Y-OWN 41

HILTON 37

HAVERHOLWEST 49

Legllydd 51
Rhydwen 49

John W. 50
CAP MARTIN 52
P. M. M. Hyr

36
LLANTYDARAN

42 MALTORD HAVEN

35 W. L. M. 31
ST ANNS 40
P. M. B. 42
P. M. B. 42

38 47 Ivy Tower
43 MANORDEIL 36
STAFFORD GOURT CAIDY 1

PEMBREY 43
Bury 37
West End 41
M. H. 41

NEATH
W. M. 51
Watch Room 51

SMITTY SWANSEA 49
PILTON GREEN 43
TANWAEN 46
OISTERLUOTH 41

162
CASHPHILL

PORTHCAWL 37
48 Ash Hill
CONRIODEL

43 40
ELY
The Camp

35 The Hill
CONRIODEL

The names in black lettering indicate the Rainfall Stations, the accompanying figures the true mean rainfall (in inches) at each.

seldom passed 70° Fahr., while the minimum varied between 19° Fahr. at St. Ann's Head and 21°·1 Fahr. at Aberystwith; the typical station of St. David's ranging from 26°·8 Fahr. to 46°·1 Fahr. The more inland station of Carmarthen, as might be expected, showed greater extremes.

Daily Mean Range.—This is largely influenced by proximity to or distance from the sea; for while the average daily mean range varies at St. Ann's Head, St. David's and Aberystwith from 7° to 9° Fahr., that at Carmarthen gives a mean of 13°·8 Fahr.

I am indebted for the following valuable contribution on the Rainfall of the Coasts of South Wales to the late Mr. G. J. Symons, F.R.S., the eminent meteorologist, who was by far the greatest authority on rainfall in these islands.

The Rainfall of the Coast of South Wales.

As an indispensable preliminary to offering any trustworthy remarks upon the above subject, I have tabulated every reliable observation known to me, and made during any one of the thirty-six years, 1860 to 1895, at any station on or within about ten miles of the coast. The positions of the stations are shown on the accompanying map. The total fall of rain at each station for every individual year is given in the table on the following page, and at the bottom of each column will be found the arithmetical average rainfall at the station, and the number of years upon which it is based—below these entries will be found in heavy type the probable true mean rainfall at that station. Very frequently these figures are identical with the arithmetical average, and without going into elaborate details, it may be well to explain broadly why they differ and how these true means are computed. Rainfall varies greatly from year to year; thus there are cases on record of two successive years the one having more than twice the amount which fell in the other, there are cases of six consecutive wet years (*e.g.* in South Wales, every year from 1874 to 1879 inclusive was wetter than usual), and there are cases of four consecutive dry years, like 1887–90. If then a record is kept merely for a few years they may have been dry years or wet years, and the arithmetical average, though

absolutely correct, would not truly represent the average of a long series of years at that place. Obviously the longer the period for which we have the arithmetical average the nearer will it be likely to approach the true mean, and accordingly, in the case of records of fifteen or more years, the two means will rarely be found to differ by an inch. For purposes of comparison the true means are much to be preferred. In order to avoid suggesting that these figures possess an accuracy greater than is possible, the decimals are suppressed and the rainfall is given for the nearest whole inch.

The general principle upon which these true means are computed is the assumption that over a considerable area the yearly fluctuation in the fall is similar. The longest available records are chosen, in this case Cardiff and Haverfordwest, and the ratio of the fall in each year to the average for the whole thirty-six years is determined—evidently a wet year will have a ratio greater than unity, *e.g.* for 1882 the ratios were at the two stations 1.32 and 1.29 respectively, if then at any station observations existed only for that year, and the record was 40 inches, the true mean fall at that station probably was $\frac{1.32}{1.31} = 30.53$ inches. Or to take an actual case in the table: the record at Caerphilly was taken only during the years 1881 to 1884, but 1882 was a very wet year, and the four years were at Cardiff wetter than the average by $7\frac{1}{2}$ per cent., the arithmetical average at Caerphilly of 67.12 therefore becomes 62.44, or as in the table where whole inches are alone given, 62.

The stations in the table are arranged in counties, and starting from Cardiff in the south-east go westward to St. Ann's Head and then north and eastward to Aberystwith.

Almost the first entry in the table gives the key to the distribution of rainfall over the district; we see that at Cardiff Castle and at Ely near Llandaff, the rainfall is about 40 inches, but at Caerphilly not a dozen miles inland it is over 60 inches, and to a less marked extent the following stations tell the same tale: Ash Hall, Cowbridge, is about six miles inland and has 46 inches, whereas The Ham and Porthcawl are close to the coast, and have respectively 35 and 37 inches. There is no doubt that all over this district, on shores exposed to west and south-west winds, the rain is driven with such an approach to horizontality that the

ROKE.

CARDIGAN.

	Haverford, West	Bridges, Pay Hutton,	St. Bridges Pay Penryn,	Solve.	St. David's.	Harlequin.	Newport (The Castle).	Elechryd Castle Malwyn.	Cardigan.	Rhyd Lewis (Treedyfawr).	Aberayon (Chaloron).	Aberystwith Castle Gronisi.	YEAR.
	96 ft.	376 ft.		96 ft.	236 ft.	295 ft.	249 ft.	80 ft.	18 ft.	149 ft.	59 ft.	59 ft.	
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	
	50.00	...	...	...	...	...	...	...	...	...	...	...	1860
	51.80	...	...	...	...	...	...	...	...	...	...	...	1861
	38.50	...	...	...	...	...	...	...	...	...	...	...	1862
	45.18	...	...	...	...	...	...	...	...	...	...	...	1863
	40.06	...	...	...	...	...	...	...	31.68	...	...	...	1864
	50.77	...	...	...	...	...	...	42.96	...	...	...	...	1865
	54.97	...	...	...	...	...	...	44.06	...	...	...	...	1866
	55.87	...	...	...	...	...	...	46.64	...	...	...	...	1867
	56.01	...	...	...	...	...	...	48.21	...	...	...	...	1868
	54.60	...	...	...	...	...	...	44.11	...	...	...	...	1869
	40.01	...	...	...	...	...	...	49.24	...	...	...	...	1870
	46.73	...	...	...	...	...	...	...	...	...	...	...	1871
	60.78	...	...	...	...	...	...	68.26	...	...	...	...	1872
	45.67	...	...	...	...	...	...	35.66	...	...	...	...	1873
	51.15	...	...	...	...	...	...	43.94	...	...	...	...	1874
	58.43	...	...	...	...	...	...	46.69	...	...	...	...	1875
	53.49	...	...	...	...	...	...	45.61	...	...	...	...	1876
39	64.18	...	...	...	...	...	...	54.07	...	...	...	...	1877
41	54.05	...	...	...	...	...	...	46.10	...	...	...	...	1878
45	40.69	...	...	...	...	...	...	40.18	...	...	...	...	1879
64	40.76	...	...	...	...	...	...	43.94	...	...	...	...	1880
65	45.18	...	...	...	...	...	...	45.82	...	...	...	...	1881
90	63.39	...	...	...	...	...	...	61.16	...	...	...	...	1882
13	50.75	...	...	...	...	...	...	51.14	...	...	37.39	...	1883
19	43.60	...	...	...	...	...	...	44.95	...	...	36.75	...	1884
53	50.27	...	...	...	...	...	...	42.10	...	...	32.24	...	1885
59	57.64	...	...	...	...	...	...	55.10	...	...	...	34.34	1886
41	35.23	...	...	...	...	...	...	29.33	...	29.46	26.57	21.59	1887
68	47.08	...	...	...	...	...	...	45.80	...	42.25	34.23	25.96	1888
94	37.81	...	...	...	...	...	...	33.57	...	34.31	33.41	29.02	1889
54	42.82	...	...	...	...	...	...	39.15	...	37.72	34.69	26.68	1890
15	51.13	...	...	...	...	...	...	48.82	...	43.69	40.86	29.35	1891
56	37.45	...	...	...	...	...	...	33.34	...	31.33	29.88	23.84	1892
72	35.55	26.74	...	...	...	...	...	35.48	...	30.48	29.23	24.89	1893
88	49.75	38.35	...	...	...	...	...	51.15	...	...	...	29.70	1894
112	38.79	...	34.48	...	...	...	...	36.82	...	36.71	...	25.68	1895
789	49.01	32.55	34.48	33.89	34.82	36.99	36.20	44.08	31.68	36.10	33.47	27.10	
9	36	2	...	22	16	2	4	30	1	9	10	10	
15	49	37	44	32	38	41	48	44	39	42	38	27	

[To *face* p. 338.]

amount reaching the surface is lessened and that rain-gauges when fully exposed to the wind collect too little. There is startling evidence of this at Aberystwith where a rain-gauge in a thoroughly exposed position on the Castle grounds gives an average of only 27 inches. This was so obviously too small that a second gauge was placed in a garden sheltered from the wind, and there the fall has proved to be 7 inches greater.

We are here not dealing with inland rainfall, but, to prevent misconception, it may be well to point out that diminished velocity of the wind is not the only reason for heavier rain inland; the other cause being the hills or mountains which generally act as condensers.

Speaking generally the rainfall all along the coast may be taken at 40 inches, less at places exposed to strong winds like Porthcawl, Caldy Island and St. Ann's Head, more, inland, even if only a few miles, as at Neath, Carmarthen and Narberth, where the fall reaches a total of from 50 to 52 inches.

With a rainfall in amount nearly double that of London, it might be assumed that it must be always raining, but that is not the case as the following table proves:—

Number of Days of Rain in the Year.

	1890.	1891.	1892.	1893.	1894.	1895.	Average 1890-95.
London ...	161 ...	178 ...	158 ...	148 ...	185 ...	137 ...	161
Cardiff ...	196 ...	189 ...	147 ...	162 ...	208 ...	163 ...	177
Swansea ...	212 ...	200 ...	182 ...	170 ...	220 ...	171 ...	192
Haverfordwest	195 ...	214 ...	227 ...	174 ...	224 ...	210 ...	207
St. David's	226 ...	198 ...	205 ...	173 ...	211 ...	182 ...	199

This shows that the days with rain on the South Wales coast are more numerous than in London by about one-fifth. Therefore while *quantity* is about 60 per cent. greater than in London, the *frequency* is only 20 per cent. more, and looking at these facts we should not be surprised to find, if the duration in *hours* instead of days had been recorded, that the former in South Wales were actually fewer than those observed in London.

There is another respect in which the coast rainfall of South Wales differs from that in London;—the excess in South Wales is chiefly in the winter months, while on the other hand, the months of April to July, both inclusive, are *relatively*, though not absolutely, considerably drier than in London.

The atmosphere of the Welsh coast is generally moist, and genuine wet days are not uncommon, but the result is seen in the rich vegetation in all localities protected from the tempestuous south-west winds, in the beautiful green sward of the hills and meadows, and in the luxuriance of copse and wood.

The relative humidity percentage varies from 80 to 87.

The Prevalent Winds are the westerly and south-easterly, and presumably the south-westerly (our records giving the wind from the four points of the compass only). The wind-force for ten years at St. David's, a very exposed station, gives an average of 17·3 miles per hour for the year, the winds being considerably stronger in winter than in summer.

Cloud Observations have been taken at St. David's, Aberystwith, and Carmarthen, and give a yearly average of 6·6 7·0, that is, on an average, two-thirds of the sky being overcast.

Sunshine Records are carried on at Tenby by the Meteorological Office, and appeared in the well-known table of twelve stations of Great Britain. According to this, Tenby has the largest number of sunshiny hours in the first quarter (January, February and March) of the year, and is only inferior to Falmouth in the last quarter (October, November and December). In the other two quarters, the sunshine is not so conspicuous.

St. Ann's Head, another station in the district, also comes out very well in this respect in the winter quarter.

CLIMATE AND PREVALENCE OF DISEASE AT CARDIFF.

Before describing the South Wales coast with its seaside haunts, we will avail ourselves of the information to be derived from the important town of **Cardiff**, which, though not a health station, can furnish us with information (1) as to the climate of the Bristol Channel generally, and (2) as to the diseases and mortality occurring under these meteorological conditions.

The mean annual temperature for Cardiff during the ten years 1886 to 1895 inclusive, was 48°·8 F.

Winter	...	...	...	...	...	39°·2 F.
Spring	...	...	...	...	...	52°·7 F.
Summer	...	...	...	...	...	59°·3 F.
Autumn	...	...	...	...	...	44°·1 F.

as the subjoined table will show :—

MEAN TEMPERATURE AND RAINFALL FOR EACH MONTH IN THE
YEAR FOR THE TEN YEARS 1886-95 inclusive.

Station, CARDIFF. Mean Temperature for 10 years, 48·8° Fahr.

MONTH.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	Mean.	RAINFALL.	
												Days.	Ins.
January . . .	37·5	37·5	38·4	38·9	41·8	35·8	36·2	36·8	39·4	33·5	37·6	17·1	3·36
February . . .	35·6	40·1	36·7	39·1	38·1	41·6	38·6	42·2	43·0	29·3	38·4	15·1	2·90
March . . .	40·7	39·1	39·8	41·8	45·1	40·8	35·9	47·1	44·4	41·6	41·6	14·2	2·53
April . . .	48·4	44·6	44·6	43·4	45·1	45·5	43·2	53·0	47·0	47·9	46·3	13·5	2·23
May . . .	53·1	50·9	52·4	55·3	54·7	50·9	50·7	57·3	49·7	54·4	52·9	13·5	2·47
June . . .	58·8	61·0	56·9	61·6	57·7	60·2	54·5	62·4	57·1	58·5	58·9	13·1	2·34
July . . .	63·0	64·6	58·1	60·8	59·7	60·2	64·1	63·6	60·3	60·0	61·4	15·8	3·55
August . . .	62·9	60·2	58·9	59·5	59·8	56·4	61·3	64·8	57·5	59·0	60·0	16·6	4·58
September . .	57·6	51·7	55·8	56·7	59·8	57·0	56·0	57·1	53·2	59·7	56·5	14·1	3·38
October . . .	52·3	43·2	48·6	52·2	47·5	48·8	42·9	51·0	50·3	46·7	48·3	17·1	4·15
November . .	45·0	39·4	47·5	46·2	45·3	41·7	43·8	43·2	47·2	44·6	48·4	4·15	
December . .	37·7	38·2	42·2	39·9	35·3	40·4	35·8	42·1	41·8	40·0	39·3	17·9	3·88

The rainfall (mean of 20 years) was 39·25, the number of rainy days, 186.

Prevalence of Disease.—Concerning this subject, Dr. Edward Walford, the energetic and experienced medical officer of health for Cardiff, has furnished the following admirable Report:—

A. Anæmia and Debility.—There is no evidence that the above conditions are unusually prevalent, although the climatic conditions might seem to favour their development, the soil being for the most part retentive of moisture, and the rainfall excessive, while the days without sunshine are probably below the average in England.

Compared with England and Wales the mortality from anæmia, chlorosis, and leucocythæmia during the years 1889-94 is as follows:—

DEATH-RATE PER MILLION PERSONS LIVING.

Year.	Cardiff.	England and Wales.
1889	70	50
1890	76	48
1891	90	54
1892	36	53
1893	28	51
1894	20	54

B. Scrofula and Tuberculous Diseases.—The above conditions do not appear to be excessively prevalent. Cardiff being a comparatively new town, the conditions under which the artisans and poor live are generally favourable to their health, and are not

such as would induce tuberculous disease. Food is cheap, and there is practically no overcrowding. It is difficult to give any exact statements as to the prevalence and mortality of these diseases owing to the vague and loose manner in which they are diagnosed and classified.

C. Diseases of the Respiratory Organs—Phthisis. — The mortality from phthisis was formerly somewhat higher in Cardiff than in England and Wales, but has been reduced considerably of late years since the drying of the subsoil by drainage. The geological formation and physical features of the town are such as might predispose to the disease. Cardiff is low-lying and difficult to drain, for the most part being situated on clay, while in the northern part, which is on gravel, the level of the ground water is high.

The occupation, however, of the working-classes would not favour the development of phthisis, being for the most part out-of-door work, connected with the coal and iron industries, or at the docks. Their houses generally are good, and with the exception of not being efficiently protected against damp they are fairly well built. There is no overcrowding. The mortality from phthisis in Cardiff as compared with that in England and Wales is given below :—

DEATH-RATE PER MILLION PERSONS FROM PHTHISIS.						
Year.	Cardiff.			England and Wales.		
1889	1987	...	1573
1890	1974	...	1682
1891	1834	...	1599
1892	1777	...	1468
1893	1615	...	1468
1894	1524	...	1385
1895	1554	...	1398
1896	1247	...	1307
1897	1211	...	1341
1898	1141	...	1317
1899	1110	...	1336
1900	1090	...	—

D. Bronchitis, Pneumonia and Pleurisy.—I have no evidence that the above diseases prevail in this district unusually: the comparative mortality is given below :—

DEATH-RATE PER MILLION PERSONS FROM PNEUMONIA.

Year.	Cardiff.	England and Wales.
1889	1481	1022
1890	2051	1404
1891	2570	1472
1892	1453	1251
1893	1573	1286
1894	1437	1084
1895	1542	1172
1896	1788	1149
1897	1164	1122
1898	1230	1129
1899	1350	1255

DEATH-RATE PER MILLION FROM BRONCHITIS.

Year.	Cardiff.	England and Wales.
1889	1898	1957
1890	1760	2333
1891	4080	2593
1892	1358	2267
1893	1327	1906
1894	1289	1642
1895	1689	1972
1896	1407	1539
1897	981	1508
1898	1000	1613

DEATH-RATE PER MILLION FROM PLEURISY.

Year.	Cardiff.	England and Wales.
1889	79	46
1890	76	66
1891	180	69
1892	66	58
1893	63	62
1894	26	49
1895	80	51
1896	79	50
1897	110	48
1898	95	48
1899	100	52

I can give no information as to the relative prevalence of renal diseases, rheumatism, arthritis and neuralgia, but have no reason to suppose that they prevail excessively.

E. Typhoid Fever.—Cardiff has been unusually free from typhoid fever during the past years.

The cases of this disease notified to the sanitary authority have been reduced from 152 in 1890 to 62 in 1894 and 79 in 1895. About one-third of these were cases imported into the district by shipping from abroad. I attribute the comparative immunity of the district from this disease to the closure of all the shallow wells in the borough, and to the excellent quality and ample quantity of the public water supply.

TYPHOID FEVER MORTALITY PER MILLION PERSONS.

Year.	Cardiff.	Large Towns.	England and Wales.
1889	259	200	180
1890	190	190	180
1891	190	200	180
1892	190	150	150
1893	120	210	220
1894	49	199	160
1895	80	200	175
1896	79	166	190
1897	110	156	180
1898	95	182	200
1899	100	199	220
1900	120		200

TYPHOID FEVER MORTALITY IN CARDIFF AND IN SOUTH WALES.
DEATH-RATE PER MILLION.

Year.	South Wales (exclusive of Cardiff).	Cardiff.
1894	171	40

F. **Diarrhœa.**—Judged by the mortality, which falls almost entirely upon very young children and occurs in the summer months of the year, diarrhœa prevails to a rather less extent than in England and Wales generally, and corresponds with that in the large towns. Diarrhœa amongst adults does not seem to be at all prevalent. The mortality from diarrhœa in Cardiff during the ten years 1885–94 averaged 1·28 per 1,000 as compared with 1·20, the average rate for the large towns during the same period. In the third quarter of the year the mortality varied with the mean temperature as will be seen by the following table:—

Year.	Death-rate per-1,000.	Mean temperature.
1886	4·6	61·2
1887	2·8	58·8
1888	1·4	57·6
1889	1·7	59·0
1890	2·9	59·7
1891	0·8	57·8
1892	2·3	60·4
1893	2·5	61·8
1894	0·5	57·0
1895	1·0	59·5

G. **Scarlet Fever** does not seem to have prevailed during the past ten years to the same extent in Cardiff as in most of the other large urban districts. The mortality is considerably below the average in the great towns. The average annual death-rate from scarlet fever during the ten years 1890—1899 was 0·17 per 1,000 in Cardiff as compared with 0·21 in the large towns for the same period.

The diminished prevalence is in great part due to the more complete isolation of the cases in the Borough Infectious Disease Hospital.

The total number of cases of scarlet fever notified within the borough and the deaths registered since the adoption of the Infectious Disease Notification Act in 1891, were as follows:—

Year.	Cases notified.	Deaths.	Percent. Case-Mortality.
1890	335	19	5·6
1891	685	35	5·0
1892	1851	87	4·7
1893	816	39	4·7
1894	577	8	1·3
1895	484	8	1·6
1896	874	28	3·2
1897	758	17	2·2
1898	332	8	2·4
1899	184	3	1·6
1900	383	11	2·8

H. **Diphtheria, etc.**—Judging by the cases notified as diphtheria, this disease would seem to have been extremely prevalent since 1892. But there is evidence to show that a considerable proportion of these cases should not strictly speaking have been classed as diphtheria; some were undoubtedly sore throats of

scarlatinal origin and others of non-specific tonsillitis. Making allowance however for errors in diagnosis, diphtheria has prevailed to a greater extent during the past few years, and Cardiff has shared in the increased incidence which has of late fallen upon urban districts.

I attribute the spread of the disease to some extent to the aggregation of young children in the large public elementary schools. The population of Cardiff has increased so rapidly of late that the School Board has been unable to keep pace as regards school accommodation with the requirements of the district: the result being that many of the schools are overcrowded. The average annual death-rate from diphtheria during the ten years 1890—1899 was, in Cardiff, 0·40 per 1,000 of the population, as compared with 0·33, the average mortality in the large towns for the same period.

The most common causes of death amongst residents are phthisis, bronchitis and pneumonia: and amongst young children debility, atrophy and inanition.

The System of Drainage.—The Urban District of Cardiff (*i.e.* the Borough) is drained by the water-carriage system: the same system of drains taking the rainfall and the household excreta and slops, etc. Practically all the houses in the district are supplied with water-closets, and are drained into the public sewers which discharge by gravitation to three separate outfalls in the Bristol Channel. The sewers are well ventilated and efficiently flushed by the rainfall, and by automatic flushing-tanks placed at suitable situations.

Water Supply.—Cardiff was formerly supplied with a hard water from Lisvane, but in 1884 Parliamentary powers were obtained for securing a new supply of water from the Taff Fawr watershed of the Brecon Beacons, situated on the Old Red Sandstone formation, beyond the northern boundary of the South Wales coal-field, and about 34 miles from Cardiff, at an elevation of from 1,100 feet to nearly 3,000 feet above the mean level of the sea. The works recently completed consist of—

(i) A storage reservoir (known as the Cautreff reservoir) with a storage capacity of 322 millions of gallons.

(ii) Balancing reservoirs at Cefn, Blackwood, and Rhubina:

also a high-level service reservoir and filters at the latter place, intended for the future supply of Penarth by gravitation, and now supplying the high-level district of Llandaff, Whitechurch, Maindy, Llanishen, Penylan, Tongwynlais, and a large portion of the district outside the Corporation area of supply through the Llandaff and Dinas Powis District Council, who take the water in bulk at the Corporation boundary at Tongwynlais and Eastbrook.

(iii) A conduit or line of pipes connecting the different reservoirs together and passing down the Taff Valley to the storage reservoirs at Llanishen and Lisvane, which are now utilized for the reception of Taff Fawr water.

The new works as originally designed, comprised two other reservoirs in the Taff Fawr Valley, Nos. 1 and 3. One of these (No. 1) is now in the course of construction, and will have a capacity of 335 million gallons, the other (No. 3) will be made when the increase of population renders further storage capacity necessary, and will contain about 700 million gallons.

By the present arrangements, pending the construction of No. 1 Reservoir, the water passes through copper-cloth strainers provided in a large straining-chamber adjoining the Cantreff reservoir. By this means the suspended particles are arrested before the water enters the main conduit pipes leading to the storage reservoirs at Llanishen, whence it passes through similar copper-cloth strainers before entering the filter-beds. It is finally filtered and passed through into a covered service reservoir at the Heath.

It is estimated that about four million gallons are supplied per day, corresponding to an average daily supply of about 23 to 24 gallons per head.

The town and neighbouring districts were until the opening of the new works, supplied partly by gravitation from works at Lisvane, and partly by pumping from a well and culverts at Ely. The water from both these sources is objectionably hard, and that from the Lisvane gathering ground possesses the additional disadvantage of being derived from cultivated land, and of containing at times an undesirable amount of organic matter in solution.

The Taff Fawr water is in every respect of exceptional purity.

The following is the most recent result of the analysis of the

town water made by Mr. Hughes, the Borough Analyst. The figures express parts per 100,000 :—

DESCRIPTION.	Total Solid Impurity.	Albuminoid Azote.	Free Ammonia.	Nitrogen as Nitrates & Nitrates.	Peculiar Sewage Contamination.	Chlorine.	Sulphuric Acid in Sulphates.	HARDNESS.		
								Temporary.	Permanent.	Total.
Llanishan Water (old)	284	0.000	0.001	0.01	nil	1.6	1.68	3.8	12.6	16.4
Ely Water (supplied)	12.5	0.004	nil	0.14	trace	1.95	3.19	15.6	14.5	30.1
Taff River Water (New supply)	6.4	0.000	0.003			0.75			4.0	4.3

EDWARD WALFORD, M.D.,

Medical Officer of Health, Cardiff.

In this admirable Report we must be strongly impressed with the enormous reduction of phthisis mortality (nearly one-half in ten years), which Dr. Walford attributes principally to subsoil drainage, and also by the satisfactory diminution in typhoid and scarlet fever deaths.

HEALTH RESORTS OF SOUTH WALES.

PENARTH.

The first health resort of any importance as we proceed westward along the coast from Cardiff, is **Penarth**, facing south-west to the Bristol Channel at the mouth of the Taff river. It has a population of 14,227, and is four miles from Cardiff, with which it is connected by rail. It lies partly in a valley and partly spread out on the slopes of the two enclosing downs, the eastern one rising into a fine bold cliff of red lias streaked with blue, grey and white layers, and crowned with a luxuriant fringe of clematis and ivy, much resembling the Aust Cliffs on the Bristol side of the Channel. Villas and pretty cottages occupy the upper part of the Downs, the lower slopes being partly fields and partly laid out as the Windsor Gardens, a pleasant promenade, due to the generosity of the late Lord Windsor. The Esplanade Hotel and

the Baths Establishment with the Yacht Club are situated along the sea-front, where is also a parade and a pier of some length.

There is a good water supply from Cardiff, and the drainage is in fair order. Boating and bathing are enjoyed from the beach, which consists of a mixture of sand and mud.

The views from the Windsor Gardens are beautiful, embracing the two Holms (Steep and Flat), the Somersetshire coast with its many headlands, and Bridgwater Bay.

Unfortunately meteorological data, or information as to the diseases prevalent at Penarth, do not appear to be attainable at present.

Penarth is used chiefly as a summer bathing-place, but is also a residence for many Cardiff merchants and men of business, who prefer to live outside that city.

The climate, as far as can be gathered from local reports and the evidence of the vegetation, is mild and moist in summer, the heat being tempered by breezes from the Bristol Channel. The winter is not severe, and the chief drawback is the lias soil, which to some extent retains the damp.

SOUTHERNDOWN.

Proceeding westwards the next spot with any claim to the title of health resort is **Southerndown**. It is reached from Cardiff by rail to Bridgend and thence by a five miles drive along an interesting road, partly through a sheltered valley, where the trees, such as sycamores and chestnuts, grow to a great size. Emerging from this valley to the sea-front we come to Southern-down, consisting of some twenty houses, including two hotels, spread over the south-western slope of a grassy and wind-swept down about 300 feet in height. To the east is the rocky promontory called Trwyn-y-Witch, or the "Witch's Nose," on which Dunraven Castle stands. These cliffs are remarkable for the horizontal stratification of the limestone which gives the appearance of a well-built stone wall, the layers of even stones seeming quite distinct, and rendered more striking where in parts there has been an upheaval of the strata.

About a mile from Southerndown there are fine sands in the bay thus enclosed, but the bathing owing to swift currents is

somewhat dangerous, especially for swimming. Further west and nearer to the place are the Ognore Sands, better adapted for this purpose.

Southerndown faces due south-west, and is so situated on the Bristol Channel as to be open to the Atlantic breezes, and the effects of this are seen in the stunted shrubs and trees, and the long walls and ramparts mostly arranged in successive lines, which are needed to protect the gardens and plantations from the wild south-wester. There is no system of drainage, and each house has its own cesspool, but the most serious drawback is the absence of a water supply, the inhabitants either storing rain-water or hauling water from a spring three miles distant.

Southerndown is principally used by Cardiff people as a watering-place in summer.

PORTHCAWL.

Separated from the last resort by the mouth of the Ognore river and a wide bay to the west lies **Porthcawl**, a small trading town with a harbour and extensive sands. It is connected by five miles of rail with Bridgend, and in consequence of its open breezy situation, facing the Atlantic, its extensive sands and its nearness to Cardiff, Port Talbot and Aberavon, it is visited for bathing. The place contains an hotel and some lodging-houses, also a Convalescent Home which has been established in connection with Cardiff.

Again proceeding westwards along the coast we come to Swansea and the Peninsula of Gower.

SWANSEA.

Swansea, a favourite watering-place of our forefathers, and still frequented in the summer by numbers of the mining population of Glamorganshire, is now a large mining and metallurgical centre, and with its copper smoke, patent fuel smoke, and other impurities, is devoted to manufacture and commerce.

Although, however, it is no longer a health resort, valuable information can be obtained as to the prevalence or non-prevalence

of diseases from the able reports of Dr. Ebenezer Davies, the experienced medical officer of health for the Urban and Port Districts of the town. Upon information kindly supplied by him the following statement is based:—

The water supply is from the mountain stream of the Lliw, which flows into two large reservoirs, called the Upper and Lower Lliw Reservoirs, but in seasons of great drought the existing supply has proved inadequate, and supplementary supplies have had to be provided from the river Cray, a tributary of the Usk. At present the water does not undergo filtration, but the establishment of filter-beds, as in other large towns, is now contemplated.

Prevalence of Disease.—*Anæmia and debility* are not common, but the influence of the climate is of doubtful value in such cases.

Scrophula and tubercular diseases, other than phthisis pulmonalis, do not prevail, and the influence of the climate is distinctly favourable to such cases.

Hæmoptysis is not a frequent concomitant of phthisis, which disease is not, according to Dr. Davies, favourably influenced by the climate.

The following table, showing the phthisis mortality in Swansea during the last forty-seven years, demonstrates a distinct decline in the said mortality.

DEATHS FROM PHTHISIS (ABOVE 5 YEARS).

Period.	Proportion to total deaths, both sexes.	Death-rate per 1,000 of population (all ages).
1849-53	1 in 9	2.6
1863-65	1 in 10	2.4
1865-73	1 in 10.6	2.2
1873-75	1 in 11.3	2.28
1876-85	1 in 10.98	1.87
1886-95	1 in 12.3	1.64

According to a Parliamentary return (1863), quoted by the late Sir George Buchanan in his report on yellow fever in Swansea in 1865, the deaths from phthisis in Swansea between the ages 15 and 55 were—males 4.05, and females 4.23 per 1,000. The following tabular statement shows that, comparing two periods of ten years 1876-85 and 1886-95 with the figures of 1863, there has been a progressive decline in phthisis mortality at those ages:—

DEATHS FROM PHTHISIS (15 TO 55 YEARS.).

Period.	Annual Rate of Mortality per 1,000.	
	Males.	Females.
1863	4.05	4.23
1876-85	3.054	2.966
1886-95	2.619	2.448

Within the above period all the works of sewerage at Swansea have been carried out, and the figures above recorded are confirmatory of the fact first observed by Sir George Buchanan, that the drying of the subsoil by deep sewerage has a marked influence in reducing phthisis mortality.

Bronchitis, pneumonia and pleurisy.—I think the rate of mortality from these diseases in Swansea must be somewhat in excess of the average of the United Kingdom generally, and appended are the statistics of two quinquennial periods, 1886-90, 1891-5, and for Swansea a third quinquennial period, compared with the Registrar-General's figures for the whole United Kingdom.

DEATH-RATE PER 1,000 OF POPULATION FROM BRONCHITIS, PNEUMONIA AND PLEURISY.

	United Kingdom.	Swansea.
1886-90	3.6	4.07
1891-95	3.97	4.0
1896-1900	—	3.2

Asthma.—As regards this disease, all my experience has led me to think that the climatic and telluric conditions of Swansea are not unfavourable to asthmatics, and I have known severe sufferers from this disease enjoy here comparative freedom from attacks.

Renal diseases do not prevail, and calculus and gravel are rare among the inhabitants, this exemption being ascribed to the pure soft water in use.

Diseases of the skin are not common, and *malarial affections* have been unknown for very many years.

Typhoid fever.—The death-rate from typhoid fever is decreasing, the annual death-rate on a mean of ten years being now 0.16 per 1,000 of the population.

Diarrhoea.—Swansea is remarkably free from this complaint, and for a long series of years has had, if not the lowest, one of the lowest death-rates of the thirty-three great towns of the United Kingdom.

Scarlet fever is not satisfactory as regards incidence, but case-

fatality is usually low. The mean annual rate for the last ten years is 14·3 per 1,000 deaths.

Diphtheria shows favourably, and gives an annual death-rate for the ten years ending 1900 of 0·40 per 1,000 deaths.

Cancer, according to the subjoined table, appears to have an increasing rate of mortality at Swansea:—

1866-75 (10 years),	150 deaths,	annual rate per 10,000	= 2·88
1876-85	285	„ „ „ „	= 4·30
1886-95	497	„ „ „ „	= 6·50

The most common causes of death are diseases of the respiratory organs, especially bronchitis, pneumonia and pleurisy. The annual death-rate for five years among persons aged 60 and upwards was 74·3 per 1,000.

The system of drainage adopted is that of water-carriage, the sewage being discharged into the sea.

PENINSULA OF GOWER.

The **Peninsula of Gower** forming the west shore of Swansea Bay has long been frequented for health purposes, and abounds in beautiful bays and well-sheltered nooks for winter residences, about which we will now say a few words.

It is oblong in form, nearly rectangular, measuring on an average fifteen miles from east to west, and five to seven miles from north to south, and is washed on three sides by the Bristol Channel, the fourth side being the broad and rather hilly neck of land connecting Gower with the rest of Glamorganshire.

The four sides face nearly due north, south, east and west, and while the south and west coast-lines are bold and precipitous, the northern slope is gradual to a comparatively level and sandy shore.

The southern coast is deeply indented with bays such as Langland, Caswell, Three Cliffs, Oxwich and Port Eynon, all remarkable either for their picturesque rocky scenery and beautiful sands, or where sheltered from winds, for the luxuriance of the vegetation, as is well seen in the grand trees of Penrice Park.

The west coast consists of bold downs and cliffs, with the fine Rhossili Bay and the curious weird Worms Head projecting to the west.

The interior of Gower forms a high table-land, with a few depressions, which from their shelter from all winds show thick woods and flourishing orchards. The table-land consists of arable and pasture land, or more often of wide commons such as Fairwood Moor and Welsh Moor, where picturesque herds of shaggy ponies graze; but out of this moorland rise certain elevations, such as Cefn-y-Bryn, the highest point, 609 feet above sea-level, and Rhossili Down and Llanmadoc Down, scattered over which are cromlechs, cairns, tumuli and other Druidical and British remains with which this part of Wales abounds. Gower is also famous for its bone-caves, especially those of Bacon Hole and Paviland, which have furnished geologists, from Dean Buckland downwards, with a rich and rare supply of bones of different periods, including those of fine mammoths, now in the Swansea Museum.

The south coast of Gower may be said to be protected from northerly and easterly winds by the high table-land in the interior, and this combined with the southerly aspect and the influence of the Gulf Stream produces a mild climate; but when we turn to see the influence on vegetation, we find that much depends on the local exposure to the south-westerly winds, which though warm and moist, by their fury check the growth of trees and shrubs even more than colder winds. In some of the bays, like Oxwich, where the shelter is complete, the vegetation closely resembles that of South Devon. Fuchsias of large size can be seen blooming out of doors, gigantic Spanish chestnuts, ashes, beeches and other forest trees flourish to the water's edge and testify, as in Penrice Park, to the shelter from wind, but where, as in the neighbouring bay of Port Eynon, there is no such protection, there are few trees, and the bay is lined with bare downs and rugged rocks.

Another feature of this south coast is the small size of the streams which flow from the hills above into the bays, and which, as Dr. Lloyd Jones¹ says, remind us of the streams of the chalk coasts of Sussex and Kent.

I have not been able to procure any satisfactory records of the climatology of Gower (other than those dealing with the rainfall, see p. 337), though such are much wanted. The rainfall at Newton, one mile from Oystermouth, is given by the Rev. Secretan Jones, M.A., Vicar of Oystermouth, on an average of

¹ *Swansea Scientific Society's Transactions*, 1892-3.

seven years, 1886 to 1892, as 41 inches; the number of rainy days being 200. The prevalent winds are westerly, and 66 per cent. of all the winds blow from the south, south-west, west and north-west, of which 25 per cent. are from the south-west.

To note briefly the Gower seaside resorts we proceed westwards from Swansea and come first to **The Mumbles**, a small fishing village and watering-place with a lighthouse, situated on the western horn of Swansea Bay, frequented for bathing in summer. This place, as seen in the vegetation, partakes of the mild climate of the district. With regard to the prevalence of disease, Dr. Bevan, the medical officer of health, has kindly prepared the following Report for the benefit of the Committee:—

Anæmia is below the average; but people suffering from it and from debility would benefit by being on the higher level.

Scrofula and tuberculous disease are rare; patients thus suffering might improve here.

Phthisis is below the average for England and Wales. As a winter resort for consumptives, Langland and Caswell Bays are recommended as open to the south and sheltered from cold winds.

Bronchitis and catarrh do not benefit from residence here.

Broncho-pneumonia is not uncommon.

Renal diseases are not often met with.

Rheumatism, especially in its muscular form, is of frequent occurrence, but *rheumatic arthritis* is more rare.

Neuralgia is fairly common.

Diseases of the skin are rare, with the exception of eczema.

Endemic Diseases—

Malaria, not unknown.

Typhoid fever: for the last six years there has been an average of 3·3 cases a year.

Diarrhœa is uncommon and certainly much below the average.

Scarlet fever is of average frequency.

Diphtheria was formerly very rare, but for the last few years a few cases have occurred.

The common causes of death are bronchitis and pneumonia, heart disease and senile decay. People live here to a good age.

Drainage and Water Supply.—There is a sewer extending from Westcross to South End, nearly a mile and a half in

length, along the line of beach under the main road. Cross branches are connected with this from the side streets and upper levels. At Westcross there is a flushing-tank, and at the outlet at South End the sewage is collected into a tank and discharged into the sea. The sewers are well ventilated. The higher part (Newton) has no sewer, the dry earth system being employed.

The water supply is derived from two streams at Caswell Bay, arising from the limestone rock. It is pumped up to Newton into a reservoir, at an elevation of about 280 feet.

The pretty bays of **Bracelet**, **Langland** and **Caswell** are suited for bathing, and the good hotels and lodgings are much frequented in summer, and as far as the shelter from north winds is concerned these places might even suit for winter residence. Beyond Langland Bay comes Pwlldu Head, and soon after the fine bay of **Oxwich**, six miles across, well sheltered by Cefn-y-bryn to the north, with splendid sands, and separated from the next bay to the west, **Port Eynon**, by the Oxwich promontory. Oxwich Bay is perhaps one of the most protected spots of Gower, and here the woods of Penrice reach to the water's edge. This bay is well fitted for a winter residence, being abundantly supplied with water, sheltered from all cold winds, and facing due south, but with the exception of Penrice Castle and a few scattered cottages, there is no accommodation for residents or visitors.

Crossing Oxwich Point to the west we come to Port Eynon, a less deep indentation in the coast, and with a south-westerly aspect it is as bare and wind-swept as Oxwich Bay is sheltered and wooded. The sands are fine and there is a good deal of fishing carried on.

We next pass Moseley and Three Cliffs Bay, picturesque and rocky, and after them Port Eynon Point. Here the coast trends to the west to the Worms Head, the western extremity of Gower, and thence passing northwards forms Rhossili Bay, the northern limit of which is a low sandy spit called Bury Holmes.

Rhossili Down, running north and south, forms the western coast of Gower, and is composed, like the Worms Head and the various cliffs and headlands of this part of Gower, of greatly contorted limestone, arranged as at Southerndown in layers in which great upheavals of the strata have taken place.

The west coast of Gower with its breezy downs, clothed with heather and gorse, rising 400 to 500 feet above the Channel, and enjoying commanding and magnificent views of the opposite coasts of Pembrokeshire and Carmarthenshire, with its interesting cromlechs, cairns, ancient British camps, and other antiquities, seems intended for health stations to supply the wants of the dwellers in Swansea, Llanelly and Port Talbot. There are not wanting also high-lying villages such as Llangenydd, Llanmadoc and Cheriton, where at present very simple accommodation is available, which might be much improved and extended. The district of Llangenydd is well supplied with water, and there is some shelter to the north and north-east, but to the west, south-west, and north-west it is entirely exposed, and I am informed that in the winter the north-west winds are very tempestuous, so though the region is well fitted for summer stay it is hardly suitable for winter.

The northern shore of Gower has no special recommendations for health purposes, but *taking the peninsula as a whole, it certainly presents advantages both for mountain and seaside residence for both summer and winter seasons, advantages which hitherto have been but very little appreciated.*

Crossing the Loughor and entering Carmarthenshire we pass along the coast of Carmarthen Bay, into which the Towy and the Taff pour their streams and form important estuaries.

The coast-line contains the harbours of Llanelly, Pembrey and Kidwelly, separated by extensive sandy dunes, but there are no seaside bathing-places of importance except at Ferryside and Pendine, before Tenby is reached.

FERRYSIDE.

Ferryside, a small watering-place situated on the estuary of the Towy, is much frequented by Carmarthenshire people in summer, and also used as a residence by Llanelly manufacturers. The best houses stand at some height above the shore, and enjoy good views of Llanstephan Castle and of the opposite coast.

There is bathing from the sands, largely mixed with mud of the broad estuary, and a good deal of boating and fishing of various kinds.

MONTHLY MEANS FOR THE TEN YEARS 1880-89.
 Station, CARMARTHEN. Height above Mean Sea-level, 200 feet.

Month.	Mean Pressure of Atmosphere in Month.	TEMPERATURE OF AIR IN MONTH.						WIND.				RAINS.				
		1 Highest.		1 Lowest.		Monthly Range.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Mean Temperature of Air in Month.	Mean Humidity.	W.		Mean Cloud.	Days of Fall.	Inches.
												N.	E.			
January	30.05	55.3	37.8	18.5	44.9	34.5	10.4	39.7	90	8.4	8.8	9.4	6.8	5.2	20	4.65
February	30.00	55.9	22.1	33.8	46.1	33.3	11.1	40.6	88	8.4	13.1	4.2	5.0	7.2	16	3.64
March	29.93	61.7	15.0	46.7	48.6	35.0	13.6	41.8	98	7.4	6.8	3.3	8.1	6.7	16	3.68
April	29.76	74.5	25.1	49.4	54.1	38.4	15.7	46.2	72	7.1	14.2	3.6	3.3	6.4	14	2.52
May	29.94	77.2	31.5	45.7	59.9	44.2	14.7	52.0	71	5.7	9.0	6.3	5.6	6.7	15	2.91
June	30.01	83.9	33.5	48.4	65.3	49.2	16.1	57.3	71	11.6	6.1	4.3	5.6	6.4	14	2.86
July	29.93	84.2	38.5	45.7	66.6	51.9	14.7	59.2	73	7.2	9.4	5.7	9.6	7.4	18	4.61
August	29.95	81.0	38.3	42.7	66.7	50.6	16.1	58.7	76	5.7	4.5	7.0	12.2	6.2	17	3.78
September	29.99	81.0	32.2	48.8	63.6	48.1	15.2	56.0	80	7.1	8.6	4.4	7.6	6.4	17	4.20
October	29.93	74.8	21.5	50.3	56.0	42.3	13.7	49.2	81	7.4	9.0	2.8	8.2	6.9	20	5.21
November	29.88	63.9	21.3	42.6	50.8	39.6	11.2	45.2	87	4.4	10.2	3.1	11.5	7.3	23	5.84
December	29.96	55.0	18.5	36.5	45.2	34.5	10.7	39.9	91	4.7	7.9	3.8	7.7	7.2	20	4.75
Annual	29.94	84.2	23.8	45.5	55.7	42.9	13.8	48.8	80	7.9	10.2	5.4	9.7	6.9	210	48.65

1 Highest and Lowest = Absolute Highest and Lowest in Period.

The following meteorological tables of **Carmarthen** (see also p. 358) give some idea of the climate of the district. Carmarthen stands on high ground above the river Towy at some distance from the coast, and its climate is practically somewhat colder:—

MEANS FOR THE TEN YEARS 1880-89—QUARTERLY AND YEARLY.

Station, CARMARTHEN. Height above Mean Sea-level, 200 feet.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.			Mean Temperature of Air.	Mean Relative Humidity.	Mean Cloud.	RAIS.	
	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March . . .	46·6	34·9	11·7	40·8	85	7·1	52	11·97
April—June . . .	59·8	43·9	15·5	51·5	71	6·5	43	8·29
July—Sept. . . .	65·6	50·9	15·3	57·9	77	6·7	52	12·50
Oct.—Dec. . . .	50·7	38·8	11·9	41·4	87	7·1	63	15·80
Whole year . . .	55·7	42·9	13·8	48·8	80	6·9	54	14·65

The Committee are indebted to Dr. Henry C. Buckley, late medical officer for Llanelly Urban District, for the following interesting Report on the mortality of the district, which throws some light on the **prevalence of disease** in the whole region:—

I. *Anæmia and debility* are not unusually prevalent.

Scrophula and tuberculous diseases do not prevail, except in the form of pulmonary consumption.

Diseases of the respiratory organs: Phthisis (with special reference to hæmoptysis), bronchitis and catarrh, pneumonia, pleurisy, and asthma. The following figures are taken from my Annual Report, 1885, and give a fair average sample of the prevalence of these diseases in the Llanelly district:—

Number of deaths.	Diseases.	Per 1,000 of Population.	Per 1,000 deaths.
48	Phthisis	2·22	118·22
42	Bronchitis and Catarrh	1·95	103·44
38	Pleuro-pneumonia	1·76	93·59
nil	Asthma	nil	nil
<u>128</u>		<u>5·93</u>	<u>315·25</u>

So far as my memory serves me, hæmoptysis occurs in the vast majority of cases of phthisis; indeed, I think I might say, few cases run their course without it.

Renal diseases.—Granular kidney is uncommon. Calculus and gravel are also decidedly infrequent, the water being soft—containing however a small percentage of lime.

Rheumatism, rheumatoid arthritis and neuralgia.—These, with the exception of rheumatoid arthritis, are decidedly prevalent.

Skin diseases are not very prevalent, but frequent examples of *eczema* have been brought under my notice.

Malarial affections some thirty or forty years ago prevailed in the low-lying and marshy lands, but drainage has latterly almost eradicated this class of disease. *Typhoid fever* is endemic, occasionally assuming an epidemic form. *Diarrhoea*: infantile and summer, are very prevalent, especially during the fruit season. I have often thought however that apart from the summer heat and fruit, much was due to bad sanitation. Epidemics of *scarlet fever* are common, some of which have assumed a malignant type. *Endemic sore throat* is unknown. Cases of *diphtheria* are very rare.

Out of 406, the total number of deaths in the year 1885, 21 were the result of heart disease. Convulsions (infantile) form one of the largest items in the death-return, but as the disease producing them is not stated in the death certificate, the heading is valueless as a cause of death.

I am strongly of opinion that people here live to a good old age, and could, I think, prove this if I went into statistics.

II. The system of *drainage* adopted consists of egg-shaped sewers, ventilated at intervals.

III. *The Water Supply.*

Two storage reservoirs exist, one large and the other small. The water is periodically examined, and the quality found to be good. It is to some extent derived from springs, but by far the largest proportion is rain-water. It is soft, containing only traces of iron and lime.

TENBY.

Tenby, a town of 4,400 inhabitants, stands on the western side of Carmarthen Bay on the south-west coast of Pembrokeshire, being built about 100 feet above sea-level on a rocky pro-

montory running east and west, and having the sea on its north and on its south.

Beyond the end of the peninsula called the Castle Hill (the precincts of the Castle being tastefully laid out in public gardens) lies the craggy island of St. Catherine's, undermined by caverns which are rich in sea-weed and zoophytes, and through which ebbs and flows the tide; the island top has been levelled, and is now crowned by a Government battery of nine guns. Further to the south is the island of Caldy and the adjoining rock of St. Margaret's, and these, with the fine headland of Giltar Point (200 feet in height), form a natural breakwater against the storms of the Atlantic, and thus provide a comparatively smooth haven to the south of Tenby.

The town is situated between two bays, the north and south, each provided with splendid sands, white and firm, well adapted for bathing and for walking or riding, while the various islands, rocks and caves supply an abundant marine fauna and flora to the enthusiastic naturalist.

Tenby is considerably sheltered to the north by the hills of which its promontory is a continuation, also on the west by the lofty coast-line ending in St. Gowan's Head, while, as has been before said, there is abundant shelter from the boisterous south-westers. To the east it is open, the hills of Gower and the Glamorganshire range not being sufficiently near to afford protection, but there is no doubt that the almost insular position of Tenby with regard to the Gulf Stream currents, and its protection from south-westerly gusts, ensure for it remarkable mildness of climate in winter and temper the heat of summer. The rainfall is 45 inches.

The town, which retains a large portion of its old walls, has good hotels, boarding-houses and lodgings, and has many public promenades on both sides, so that invalids can vary their walks according to the prevalent wind. The drives in the neighbourhood to the old castles of Manorbier, Carew and others, are most interesting, and the golf links are much appreciated. In addition to the sea-bathing there is a well-equipped bath establishment.

Mortality and Prevalence of Disease.—The Committee have to acknowledge the following important information as to the health conditions and prevalence of disease at Tenby, kindly

furnished by Drs. Douglas, A. Reid, and Knowling, medical practitioners at Tenby, and by the late Mr. J. Griffith Lock, medical officer of health.

The death-rate for 1895 was 16·6 per 1,000, for 1894 it was 15·8: the birth-rate for 1895 was 21 per 1,000. There were no deaths in 1895 from zymotic diseases, but three from influenza. Anæmia and debility seem very rare, as also scrofula and tubercular diseases, other than pulmonary tuberculosis; but according to Mr. Lock's statistics of Tenby mortality for fifteen years¹ a very large proportion of the deaths among the residents were due to phthisis. However, deaths from this cause among the visitors are almost unknown. Hemoptysis is very rare. Pneumonia and bronchitis, according to Mr. Lock's report, are some of the chief causes of death. Asthma is rare, and the same may be said of renal diseases, rheumatism, rheumatoid arthritis and eczema.

Neuralgia, according to Dr. Reid, is less rare. During 1895 five cases of scarlet fever were reported (all in the same house), and two cases of diphtheria. No case of typhoid fever had occurred since 1893, and that was imported.

Malarial affections are unknown, and endemic sore throat is very rare.

A very common cause of death appears to be old age, octogenarians being numerous, and nonagenarians are met with, and even occasionally centenarians. In 1895 ten deaths were from old age, four males and six females. The ages of the former averaged 78 $\frac{3}{4}$ years, the latter 83 $\frac{1}{2}$ years; one woman dying at 97, and another at 93. I note also in Mr. Lock's report for fifteen years (1872-86) the largest proportion of deaths were from old age.

As to **drainage**, the sewage is conveyed through earthenware pipes into the sea at two points, the outlets being at some distance from the bathing-places. The sewers are ventilated by shafts erected by the Sanitary Authority, and supplied with flushing-tanks to carry out daily flushing. A portion of the sewage is conveyed for fertilizing purposes to a spot at some distance from the town.

The **water supply** is pure and abundant. In the winter it flows by gravitation from springs called the "Lady Well" into a service reservoir well protected from contamination a mile from

¹ *Bristol Medico-Chirurgical Journal*, 1893.

Tenby. In the summer it is pumped into the same reservoir from springs at Cashwell, about two miles distant. The supply is carried to the tops of the highest houses and is practically unlimited, for even in seasons of drought it is freely used for watering the gardens, and never runs short. The analysis has been very satisfactory, but the authorities contemplate in addition the construction of filter-beds at a considerable cost.

The Therapeutic Value of the Climate of Tenby.—A beneficial effect is exercised by the climate on all that class of tubercular affections which are improved by abundant sea air, such as strumous joint and gland affections, and especially those in which good salt-water bathing is also called for, as the opportunities for bathing are excellent. In anæmia and renal diseases, especially albuminuria, the abundance of sunshine is favourable, and the climate also has a good reputation, according to Drs. Reid and Knowling, in cases of bronchial asthma. Chronic phthisis generally benefits. At present Tenby is used principally as a summer residence on account of its great advantages for bathing and boating, but all evidence points to its serving as an excellent winter station, by no means inferior to those of Devonshire and Cornwall.

It is principally indicated in strumous affections, especially of children, and in anæmia, and from the equability of this climate it is well suited as a residence in old age.

After Tenby and its beautiful bays, the coast runs south-west to St. Gowan's Head, and north-west to Milford Haven. The whole of this sea-line consists of precipitous cliffs, the contorted limestone forming splendid caves and fissures, through which the high tide boils and foams and often rises in geyser-like columns of spray, while the black beetling cliffs reach the height of 160 feet at St. Gowan's Head, and when detached from the coast, as in the case of the two lofty outworks of the Stack Rocks, become the haunt and breeding-place of thousands of sea birds.

Romantic as this part of the coast is, it offers no sites for health stations.

We now cross Milford Haven to its northern portal of **St. Ann's Head**, where meteorological observations are kept for the daily weather reports of the Meteorological Council. These have

MONTHLY MEANS FOR TWENTY-FIVE YEARS (1871-95).

Station, ST. ANN'S HEAD, PEMBROKE. Height above Mean Sea-level, 150 feet.

Meteorological Office, Observer.

MONTH.	Mean Pressure of Atmosphere in Month.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month.	Mean Relative Humidity.	RAIN. Inches.
		1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.			
January	29.93	52	19	45.1	39.0	6.1	42.0	88	3.71
February	29.94	52	23	45.3	39.0	6.3	42.1	89	2.62
March	29.93	58	26	46.6	39.0	7.6	42.8	86	2.26
April	29.87	70	30	50.7	42.0	8.7	46.3	89	1.89
May	29.96	72	34	55.1	46.0	9.1	50.5	85	1.96
June	29.98	79	38	60.5	51.6	8.9	56.0	87	1.88
July	29.93	80	45	62.4	54.8	7.6	58.6	87	2.53
August	29.92	78	47	63.0	55.6	7.4	59.3	87	2.88
September	29.96	74	40	60.3	53.1	7.2	56.7	85	3.32
October	29.87	66	33	54.7	47.8	6.9	51.2	87	4.11
November	29.87	58	28	50.3	43.6	6.7	46.9	87	4.04
December	29.91	55	19	47.0	40.5	6.5	43.7	90	3.96

1 Highest and Lowest = Absolute Highest and Lowest in Period.

MEANS FOR TWENTY-FIVE YEARS (1871-95)—QUARTERLY AND YEARLY.

Station, ST. ANN'S HEAD, PEMBROKE. Height above Mean Sea-level, 150 feet.

Meteorological Office, Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.			Mean Temperature of Air.	Mean Relative Humidity.	RAIN. Inches.
	Mean of Highest.	Mean of Lowest.	Mean Daily Range.			
Jan.—March . . .	45.7	39.0	6.7	42.3	88	8.59
April—June . . .	55.4	46.5	8.9	50.9	86	5.73
July—Sept. . . .	61.9	54.5	7.4	52.2	86	8.73
Oct.—Dec.	50.7	43.9	6.4	47.3	88	12.11
Whole year . . .	53.4	46.0	7.3	48.2	87	35.16

been utilized for the present paper, and in the accompanying tables the chief results are tabulated.

In reading the temperatures, it must be remembered that owing to St. Ann's Head being in so exposed a position, the observations will not quite represent the climate of a more sheltered locality in the same district.

ST. BRIDE'S BAY.

We now pass round a craggy headland into **St. Bride's Bay**, one of the most picturesque bays in South Wales. It opens nearly due west, and its southern horn is formed by St. Ann's Head and the rocky islands of Skokholm and Skomer, which, like the neighbouring town of Haverfordwest, derive their names from the Norse inroads of olden times.

The northern horn is formed by the magnificent peninsula of St. David's with the mountain of Carnedd Llidi and the large island of Ramsey. The bay measures $7\frac{1}{2}$ miles across, and at low tide presents, as we find along most of this coast, beautiful firm white sands, delightful for bathing and walking. The bay also offers facilities for boating and fishing, and simple accommodation is to be had in summer at the little villages of **Broadhaven**, **Newgal**, and **Solva**.

Being much open to south-westerly winds and the storms from the Atlantic, we cannot regard this beautiful bay as a possible winter station, but it might be much more utilized by South Wales people in summer, as the climate is breezy and refreshing in hot weather.

St. Bride's Bay is approached by a $7\frac{1}{2}$ miles drive from Haverfordwest, the nearest station to Newgal, the road passing over a hilly but well-cultivated country, giving splendid views of the bay and of St. David's Head.

Passing the little bathing village of Newgal we are struck by the picturesque situation of Solva in a narrow creek or loch of the sea into which the river Solva or Solfach falls, after a wandering course between precipitous banks. The whole of this bold coast resembles the north Cornish sea-line, and Solva itself has a great likeness to Boscastle.

ST. DAVID'S.

The ancient city of **St. David's**, which is now merely a village, stands on the peninsula ending in St. David's Head, between St. Bride's and Cardigan Bays, 16 miles from Haverford-west. The lofty table-land round it is cultivated, but produces very poor crops, and out of the cultivated lands rise two fine elevations, Carnedd Llidi and St. David's Head, covered with splendid gorse and heather. The houses are clustered on the table-land a mile from the sea on one side, and still further on the other side, in as bleak and desolate a spot as can be imagined, open to all the winds of heaven with scarcely a tree to protect it, but the grand old cathedral and beautiful Bishop's Palace and the College, the two last now in ruins, were by the wise design of their founder, St. David, placed in a depression below the village and are completely sheltered. The cathedral Close, with the stream Alan flowing through it, and the picturesque ruins encompassed by an ancient wall of defence present a scene of repose and refuge from the external storms, which contrasts strangely with their bleak and boisterous surroundings.

The coast here is very precipitous, consisting of dark slabs of slate and shale descending a sheer hundred feet into the raging and foaming sea. The whole coast, with the rocky islands of Ramsey and the Bishop and his Clerks, is too precipitous to allow of many bays with strands, and with the exception of White Sand Bay, near St. David's, there are few facilities for bathing.

St. David's has long been a station of the Meteorological Office, and

MEANS FOR THE TEN YEARS 1881-90—QUARTERLY AND YEARLY.

Station, ST. DAVID'S, PEMBROKESHIRE. Height above Mean Sea-level, 196 feet.

W. PEREGRINE PROPERT, LL.D., Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.			Mean Temperature of Air.	Mean Relative Humidity.	Mean Maxima in Sun.	Mean Cloud.	RAIN.	
	Mean of Highest.	Mean of Lowest.	Mean Daily Range.					Days.	Ins.
Jan.—March .	45.4	37.7	7.8	41.6	88.1	70.5	6.9	55.3	8.91
April—June .	56.5	45.6	10.9	50.6	87.3	109.4	5.9	45.9	6.36
July—Sept. .	62.8	51.7	10.5	57.4	88.2	112.2	6.4	49.1	8.72
Oct.—Dec. .	50.5	42.1	8.3	46.7	87.2	78.6	7.2	64.1	12.05
Whole year .	53.8	44.3	9.3	49.1	87.7	94.9	6.6	214.4	30.04

MONTHLY MEANS FOR THE TEN YEARS 1881-90.
 Station, St. David's, PEMBROKESHIRE. Height above Mean Sea-level, 196 feet.
 W. PEREGRINE PROPERT, LL.D., Observer.

Month.	Mean Pressure of Atmosphere in Month.	TEMPERATURE OF AIR IN MONTH.							Mean Temperature of Air in Month.	Mean Relative Humidity.	Mean Maxima in Sun.	WIND.				RAIN.							
		1 Highest.			1 Lowest.			Monthly Range.				Mean of Highest.	Mean of Lowest.	Mean Daily Range.	Strength.	N.	E.	S.	W.	Mean Cloud.	Days it fell.	Inches.	
		°	°	°	°	°	°	°															°
January	29.67	50.6	28.5	22.1	45.1	37.8	7.3	41.7	89.7	70.5	19.3	3.6	7.0	7.4	9.4	7.5	21.0	3.53					
February	30.0	49.7	29.2	20.5	44.9	37.8	7.0	41.3	88.5	78.0	18.7	3.9	6.6	4.4	5.7	6.9	16.8	2.80					
March	29.63	53.5	27.0	26.8	46.3	37.4	9.0	41.8	86.3	90.1	17.7	5.7	6.3	4.7	6.9	6.2	17.5	2.58					
April	29.89	60.2	33.1	27.1	51.7	41.0	10.8	45.3	86.4	103.2	17.2	6.1	5.7	4.1	7.0	5.7	15.9	2.00					
May	30.12	65.8	38.6	27.1	56.7	45.6	11.1	51.0	87.2	110.0	14.9	6.5	3.7	6.4	3.9	6.0	14.7	2.29					
June	30.0	71.0	44.5	24.5	61.3	50.3	11.0	55.6	88.4	115.1	15.1	7.9	2.6	7.3	6.4	6.0	15.3	2.07					
July	29.93	71.4	48.1	22.7	63.2	53.1	10.0	57.8	89.6	116.0	15.3	5.5	1.2	7.2	9.5	6.8	17.6	3.08					
August	30.0	70.3	46.6	23.7	63.9	52.7	10.7	58.3	88.1	114.3	15.8	4.5	2.1	5.8	10.3	6.1	15.4	2.45					
September	29.98	66.9	43.2	23.7	61.2	49.3	10.9	56.2	86.9	105.4	16.6	5.4	5.6	4.3	5.4	6.2	16.1	3.19					
October	29.93	60.0	37.7	23.5	51.5	45.0	9.4	51.0	86.3	91.3	18.9	7.6	5.6	2.8	7.3	6.9	20.4	3.69					
November	29.88	56.4	31.5	24.9	51.0	42.8	8.2	46.8	87.4	76.6	19.8	2.7	4.9	5.0	9.2	7.4	21.9	4.35					
December	29.95	52.4	26.8	25.5	45.9	38.5	7.4	42.3	87.9	67.9	18.8	4.7	5.5	4.6	7.5	7.3	21.8	4.01					
Annual	29.96	71.4	26.8	24.3	53.8	44.3	9.3	49.1	87.7	94.9	17.3	64.1	56.8	64.0	88.5	6.6	214.4	36.04					

1 Highest and Lowest = Absolute Highest and Lowest in Period.

the exceedingly able and obliging observer, Mr. Peregrine Propert, LL.D., has recorded one of the most complete set of observations in Wales. On the preceding pages an analysis of these is given.

A report is annexed of the **prevalent diseases**, kindly prepared for the Committee by the medical officer of health of St. David's, Dr. W. H. Williams:—

"*Anæmia* is common among young women. Scrofulous and tubercular diseases, except *phthisis pulmonalis*, are rare.

"*Phthisis* is not common among residents or visitors; but I have observed that many healthy young people from the neighbourhood, after leaving the pure air to undertake work in shops, manufactories or mines, return here with phthisical symptoms: some die, but I believe that some recover.

"*Bronchitis* and *catarrh* are often met with.

"*Pneumonia* and *Pleurisy*.—Idiopathic simple pneumonia is generally rare, though at times it almost appears to be epidemic. Pleuro-pneumonia is more common, and broncho-pneumonia, among very young and very old people, more common still. Simple pleurisy is rather rare.

"I do not remember meeting with a case of *bond-fide asthma*. What goes by that name is usually emphysema, which is not uncommon. *Acute renal dropsy* is very scarce, but *dropsy* from heart disease is more frequent. *Chronic albuminuria* is rare, except where associated with granular kidney: *calculus* and *gravel* are fairly common. *Rheumatism* and *rheumatoid arthritis* and *neuralgia* are often met with.

"All *skin diseases* are rare, except eczema or impetigo capitis in infants and young children.

"I have never known a case of *malaria* contracted here, but a few sailors have come home suffering from it.

"*Typhoid fever* is rare.

"*Diarrhoea* is rare among natives, but visitors seem, on first arriving here, to suffer slightly in this way.

"*Scarlet fever*: I have not known a case in this parish since I have been in practice (eight years). In neighbouring parishes there have been two slight epidemics.

"*Diphtheria* is rare, but endemic sore throat is very common.

"The commonest causes of death are cerebral hæmorrhage, broncho-pneumonia, heart disease and dropsy, and bronchitis.

"A large proportion of the permanent residents live to old age—one reached nearly to 100 years. Of the deaths in the district in 1896 the mean age was $50\frac{1}{2}$ years.

"St. David's has no system of drainage. There are 'pitched' open gutters which are supposed to carry off nothing but surface-water. All offensive liquids are thrown into the ashpit or garden. As to the closets, either the pail or dry earth systems are adopted. There are few water-closets, and those that exist are connected with underground cesspools. The water supply is good, the water being obtained from wells, for the most part of considerable depth."

This Report shows that the prevalent diseases are those to be expected in a locality where the climate contains a large amount of moisture, and the protection from wind is small.

The winter climate is mild and the range small, but with so much wind it would be impossible to recommend it for invalids. For the summer it is a different matter: in hot dry weather the fresh winds of St. David's laden with a large amount of saline material would be very acceptable to many, though the distance (sixteen miles) from a railway-station makes the place difficult of access. Moreover it cannot be said at present that accommodation of a suitable character exists for the reception of invalids.

FISHGUARD BAY.

Proceeding northwards from St. David's, we pass over a hilly country with abundant pasture land across the bold headland of Pencaer, and descend (after about seventeen miles) into **Fishguard Bay**, which faces nearly due north, and from the shore of which the Irish coast is often visible.

The bay of Fishguard is about three miles wide, its limits being Pencaer and Strumble Head on one side and Dinas Head on the other, and falling into it and forming the romantic little port of Fishguard is the salmon stream of Gwayn, the valley through which this flows being remarkable for its warmth and shelter and luxuriant vegetation. The valley runs from north-west to south-east, but has so meandering a course among the hills, that scarcely any wind can penetrate its recesses, and where the aspect is southerly and the heat retained by the sloping rocks, as in Mr.

John Worthington's gardens at Glyn-y-mel, escalonias, lemon verbenas of considerable size, camellias, fan palms (*Chamaerops humilis*) and Japanese medlars grow and flourish in the open. The eucalyptus globulus survives ordinary winters, but is killed by severe frosts such as occurred in February 1895. The sacred lotus blooms in some of the water-tanks.

Lower Fishguard is at the mouth of this valley and shares much of its shelter and warmth. Upper Fishguard lies above the little harbour on a ridge facing north, and is more exposed and breezy. Lodgings are to be found in both places.

On the western ledge of Fishguard Bay facing south-east nestles **Goodwick**, a charming little village commanding a fine view of the bay and of Dinas Head. It is much frequented in summer on account of the bathing and mountain air, for above it rises Pencaer, the highest land of Strumble Head, and it was at a spot called Carreg-Wasted Point, three miles from the village, that 1,500 French landed in 1790, and being overawed by the sight of the petticoats of the Welsh women on the hills above, surrendered unconditionally to a small body of local yeomanry and militia commanded by Lord Cawdor. On the slopes of Strumble Head the air is fine and bracing, and consequently in summer never too hot. Meteorological observations have been taken for thirty years, but unfortunately the instruments were not placed under the same conditions as at the other stations, and therefore are not comparable. Sir Hugh Owen, a resident of thirty years' standing, informed me that spring was very long and uncertain, and often continues till June, and that in the early months of the year the weather was sometimes windy and stormy. The winter temperatures have been known to fall to 22° F. as in 1894, and even in 1878 to 17° F. The summer and autumn climate is very fine.

Goodwick has an excellent hotel, the "Wyndcliffe" (formerly the residence of Mr. Alfred Morrison), and in the beautiful gardens the same luxuriance of vegetation and growth of semi-tropical trees are seen as at Glyn-y-mel. A series of terraces and shady walks extend from the sea-level to some height up the mountains, and the whole garden is well exposed to the sun, and sheltered from winds, especially from the south-wester, though it is open to the north-west. Myrtles, magnolias, bamboos and eucalyptus globulus flourish, and one specially notices two fan palms, 8 to 10 feet in

height, which have blossomed and fruited in the open air, and to judge by their rings of dead leaves must be at least ten years old, and yet have never been protected during winter.

Therapeutic indications of the Climate.—From the extreme mildness of the usual winter climate there is little doubt that the bay of Fishguard might be utilized as a winter station, and as the accommodation at Goodwick is excellent, patients might be sent there for chronic bronchitis. In summer it is an acceptable place, on account of the fresh breezes and the mountain walks, which can be combined with good sea-bathing, hence strumous and tubercular affections might derive benefit. Goodwick is connected by the railway with London (273 miles), and can be reached in nine hours from Paddington.

Prevalence of Disease.—The Committee is indebted for the following interesting Report on the health of Fishguard to Dr. J. Hancocke Wathen of Clifton, who for many years was medical officer of health for the Fishguard district, and practised in the locality:—

FISHGUARD DISTRICT.

Population, 7,233.

Acreage, 50,076.

A. *Anæmia* and *debility* are not unduly prevalent, but nevertheless *chlorosis* and *amenorrhœa* are frequently met with among the peasant girls of the district.

B. *Scrofula* and *tubercular diseases*, except *phthisis pulmonalis*, are not common in the borough, or in the outside district.

C. *Phthisis*.—The deaths from this complaint in the whole district for the five years 1884–88 averaged each year 12·8, equal to a death-rate of 1·64 per 1,000 of the population.

Hæmoptysis, I should say, is not common.

Pneumonia, *bronchitis* and *pleurisy*.—The annual deaths from these complaints for the five years 1884–88 averaged 13·4, equal to a death-rate of 1·7 per 1,000 of the population.

Asthma is not very prevalent.

D. *Renal diseases*.

Acute renal dropsy is not common.

Chronic albuminuria is common, and is presumably associated with granular kidney.

Calculus is rare. Four cases were operated on during forty years, one of which had a recurrence. In a fifth case the presence

of a calculus was only discovered after death. This, and three of the cases operated upon, two of whom were females, occurred in the parish of Llanunda; the fifth came from Dinas parish, the calculus in this instance being of mixed oxalate and urate nature, while the others were uric acid calculi. Gravel is not very common.

E. Rheumatism and rheumatoid arthritis.

Rheumatism is very common, and is due to the dampness of the cottages in the district.

Rheumatoid arthritis is also very prevalent.

F. Diseases of the skin.—Those most frequently seen are eczema, psoriasis, lichen and scabies, the most common of all being eczema. With reference to sea-air influences upon the latter complaint, it may be stated that several inveterate cases that came from a distance were successfully treated here at the seaside.

G. Endemic diseases.

In days gone by malarial affections, such as ague and intermittent fevers were prevalent, but they have much diminished if not disappeared of late years, owing to better land drainage.

Typhoid fever.—Several isolated outbreaks of typhoid were noticed from year to year in outlying districts, but for many years before I left the neighbourhood Fishguard borough had been free from it. *Diarrhœa* was not very prevalent.

Scarlet fever was not prevalent. When it did occur it usually assumed a very mild type.

Diphtheria was for many years, I may say, absent from Fishguard borough, while in outlying districts there were frequent epidemics. In 1859–60 there was a memorable epidemic in the valleys along the Preseley range. Of late years it principally affected the tableland running from the Western Cleddau to St. David's, which is not the Fishguard district proper. Occasionally it followed the two main tributaries of the Western Cleddau, which join at Ford Bridge; but its course was up-stream, alternating on one occasion with typhoid fever. In the winter of 1868–69 I saw three isolated cases of diphtheria living many miles apart, thus . . . at the same time. Two were followed by paralysis.

Endemic sore throats did not prevail largely, and were as a rule follicular. If not that, they generally took the form of true diphtheria.

Common causes of death and frequency of old age.—Taking the year 1885 as an example in the Fishguard borough, there were

26 deaths of all ages, namely—two under 1 year; one between 5 and 15 years; one between 15 and 25 years; ten between 25 and 60 years; and twelve at 60 years of age and upwards.

In outlying districts the figures were respectively 6, 9, 6, 2, 22, and 50, or 95 at all ages.

In the borough 3 patients died of phthisis and 3 of heart disease. No death occurred from zymotic diseases.

In the outlying district the deaths were as follows:—

6	from	Scarlatina.
1	„	Croup.
1	„	Enteric Fever.
1	„	Erysipelas.
1	„	Puerperal Fever.
9	„	Phthisis.
11	„	Bronchitis, Pneumonia and Pleurisy.
8	„	Heart Disease.

Drainage and Water Supply.—A system of drainage was laid down several years ago with street ventilators, and before being discharged into the sea, the sewage passed through filter-beds, but as there was no regular system of flushing, the filter-beds broke down, and the ventilators were allowed to become choked up.

The water supply is dependent on springs and wells.

The two last answers only refer to the borough of Fishguard.

J. HANCOCK WATHEN.

16 *York Place, Clifton, Bristol,*

April 1st, 1896.

I believe the amount of phthisis and pulmonary diseases to be due mainly to the damp and ill-ventilated cottages in the county generally. My knowledge of the district does not allow me to speak of the period later than 1880 when I left the neighbourhood. It is to be noted that one-half the deaths occurred at 60 years and upwards, and extreme age was common.

J. H. W.

After leaving Fishguard the coast-line is still bold and precipitous, and the road, leaving on the right the Preseley mountains, passes inland, with only glimpses of the sea, until we reach **Newport**¹ (Pembrokeshire), situated on an estuary of the sea; then, after 18 miles of hilly country, we quit Pembrokeshire, descending into Cardigan on the Teifi river, at a short distance from its mouth.

Between Cardigan and Aberystwith lie 39 miles of road, for the

¹ Mr. G. J. Symons kindly furnished me with the rainfall of Newport, which was 48 inches.

first part chiefly inland; but after Aberaeron the route is near the sea, but at some height above it.

On the coast, north of Cardigan, are the small villages of **Aberporth** and **New Quay**, where bathing and fishing are the amusements of summer visitors. Twenty-three miles from Cardigan and 16 from Aberystwith is situated **Aberaeron** on the mouth of the Aeron, a stream that flows from the eastern slope of the Mynyddbach range, and this place commands a fine view of Cardigan Bay.

The village is composed of a few rows of houses in which lodgings may be obtained, a tolerable commercial hotel, and two or three smaller inns, and a small trading port.

It faces north-west, and is open to most winds, though there is a low sheltering range of hills, but there are pleasant downs to walk on. The beach is of large rough shingle, and there is no walk near the sea except the wharf, while though there is some bathing, it is apparently without machines or tents.

The drainage is at present by a system of cesspools, or else the sewage is discharged into the river, and there does not appear to be a separate water supply from the contaminated Aeron. It cannot be said that Aberaeron offers many attractions to visitors, though various improvements are in contemplation.

ABERYSTWITH.

Sixteen miles further north, along a remarkably fine coast road, we arrive at **Aberystwith**, one of the best known of the Welsh health stations, and connected by rail with the metropolis and other large cities. The town faces west, and slightly north-west, and is picturesquely built round the bay in the form of a crescent, the two horns of which are, to the north Constitution Hill, and to the south the promontory on which the ruins of the Castle stand. A well-paved parade lit with electricity, called the Terrace, runs along the crescent ending in the newly-founded University College, of North Wales, containing a large number of students, of whom a fair proportion are women. From the Terrace a light iron pier, on which is a concert-room, runs out some distance into the sea, and at its end a number of sheltered seats are arranged, where, as well as from the Castle grounds, a good view is obtained of the position of the town.

Aberystwith is protected to the north and east and south by a double chain of hills. The Rheidol river and the stream Ystwyth, containing scarcely any fish through the presence of lead in their waters, uniting in an artificial channel, flow into the harbour. The strength of the current thus caused is sufficient to clear the harbour and improve the navigation. The landscape as viewed from the pier is sombre, owing to the predominant grey of the slate rocks, but is relieved by the bright green of the downs above, while the effect of the Castle hill, and the fine University buildings rising from the sea is pleasing.

The beach is pebbly, and low tide lays bare a considerable tract of slate rocks, overgrown with seaweed and rich in miniature marine aquaria, the delight of the juvenile zoologist. This with the onyxes, cornelians, and other pebbles to be found on the beach, are a never-failing source of interest to the searchers after the wonders of the deep.

The rapidly shelving character of the shore, and the strong tides and currents render caution in bathing necessary, but there are plenty of machines, and sea-bathing, if not first-rate, is largely indulged in. There is also an establishment with hot and cold baths, and a good-sized swimming bath.

The population, including visitors, is 8,500, the latter being very numerous during the summer months, while some people also pass the winter here.¹

Walks abound in the neighbourhood, as up Constitution and Pendinas Hills, on the latter of which is a monument to the Duke of Wellington, and on the former a railway worked by hydraulic power; further there are endless excursions, as to the Devil's Bridge, to Hafod and Machynlleth.

Meteorology.—Aberystwith is a station of the Royal Meteorological Society, and the instruments are kept in a very exposed position on the Castle Hill. Owing to this exposure, a second station was established in the heart of the town, and protected from the boisterous wind. This, as already stated, gave a rainfall considerably in excess (7 inches) of that registered in the Castle grounds.

¹ In 1901, according to the recent census, the resident population (exclusive of visitors) has risen to 8,013.

Subjoined are the chief features of the climate :—

MONTHLY MEANS FOR THE SEVEN YEARS 1889-95.

Station, ABERYSTWTH. Height above Mean Sea-level, 59 feet.

DR. ABRAHAM THOMAS, Observer.

MONTH.	TEMPERATURE OF AIR IN MONTH.					Mean Temperature of Air in Month. °	Mean Relative Humidity. %	Mean Cloud.	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
January . . .	52·5	21·1	44·2	37·8	8·3	40·7	86·0	7·1	19·5	2·05
February . . .	53·1	25·5	45·3	36·0	9·3	40·7	83·0	6·3	14·1	1·23
March	59·2	27·0	47·8	39·3	9·9	41·0	80·8	6·6	13·2	1·34
April	66·9	31·9	51·1	41·6	12·4	47·9	74·5	5·5	12·6	1·70
May	72·0	36·4	58·4	48·2	11·8	52·6	74·0	6·4	13·8	2·00
June	74·7	40·8	63·3	51·8	11·5	57·6	79·8	7·7	12·1	1·64
July	73·7	46·2	64·0	54·6	9·1	59·2	78·5	7·6	16·0	2·72
August	74·1	44·9	64·2	55·5	8·7	60·0	81·0	8·0	17·8	3·03
September . .	75·9	42·6	63·2	52·9	10·2	68·1	78·9	6·6	13·1	1·94
October	63·6	32·4	55·7	45·7	10·0	50·6	80·0	7·1	19·2	3·95
November . . .	60·4	30·3	51·5	42·3	8·6	47·0	82·2	7·8	18·8	2·88
December . . .	53·7	25·7	46·5	38·0	8·5	42·3	84·0	7·4	17·5	2·67

MEANS FOR THE SEVEN YEARS 1889-95—QUARTERLY AND YEARLY.

Station, ABERYSTWTH. Height above Mean Sea-level, 59 feet.

DR. ABRAHAM THOMAS, Observer.

QUARTERS AND YEAR.	TEMPERATURE OF AIR.					Mean Temperature of Air in Month.	Mean Relative Humidity.	Mean Cloud.	RAIN.	
	1 Highest.	1 Lowest.	Mean of Highest.	Mean of Lowest.	Mean Daily Range.				Days it fell.	Inches.
Jan.—March.	59·2	21·1	45·8	37·7	9·2	41·8	83·3	6·7	46·8	4·62
April—June .	74·7	31·9	58·6	47·2	11·9	52·7	76·1	6·5	38·5	5·84
July—Sept. . .	75·9	42·6	63·8	54·3	9·3	62·4	79·5	7·4	46·9	7·69
Oct.—Dec. . .	63·6	25·7	51·2	42·0	9·0	46·6	82·1	7·4	55·5	9·50
Whole year . .	75·9	21·1	54·8	45·3	9·8	50·9	80·2	7·0	187·7	27·15

1 Highest and Lowest = Absolute Highest and Lowest in Period.

From these it would appear that Aberystwith is the warmest in winter of the South Wales coast and inland stations from which we have reliable observations. It seems also to have a smaller percentage of relative humidity. The number of rainy days is somewhat less than at the other stations.

However, all things considered, the observations show a mild moist climate with great equality of temperature, quite typical of the west coast. Dr. Abraham Thomas, the accomplished and indefatigable medical officer of health for Aberystwith, superintends the meteorological instruments, and has also furnished the following interesting **report on the prevalent diseases** in answer to queries:—

“Aberystwith has a very bracing climate. The town is sheltered on its northern and eastern aspects, and exposed to the Atlantic breezes on the west, the prevailing winds being westerly or south-westerly. The soil is a gravelly one.

I. A. *Anæmia and debility*.—A fair number of the young girls and women of the town are anæmic, but with the exception of a few cases associated with slight goitres they readily respond to ‘steel.’

B. *Scrophula and tubercular diseases* (except phthisis pulmonalis) are not very common amongst the inhabitants, whereas visitors suffering from these complaints are greatly benefited.

C. *Diseases of the respiratory organs*.—The phthisis mortality per 1,000 for a period of five years was 1·5. A number of cases of phthisis are seen amongst the inhabitants, but in my opinion the disease runs a more prolonged and chronic course than is usual elsewhere. Hemoptysis is not often met with in these cases. The patients are greatly benefited by a stay in the bracing mountain climate within a radius of twelve or twenty miles of the town.

Visitors suffering from phthisis are often greatly benefited by a stay at Aberystwith, but one does not often see a complete arrest of the disease.

Bronchitis and catarrh are met with in the winter months, and chiefly amongst the old people, but not in a larger proportion than one would have expected.

Pneumonia and pleurisy occur sporadically, but no cases of epidemic pneumonia have been met with.

Asthma.—Visitors from the large towns such as Birmingham,

Wolverhampton, and from the colliery districts of South Wales, seem liable to attacks of asthma, especially in misty, sultry weather. The complaint is rare amongst the inhabitants.

D. *Renal diseases* are not common. Acute renal dropsy, however, is sometimes seen, while occasionally a case of chronic granular kidney is met with, the result either of gout or lead-poisoning.

Calculus and gravel are rare.

E. *Rheumatism and rheumatoid arthritis* are met with sporadically. Neuralgia, especially of the facial type, is common, the inhabitants having very poor teeth.

F. *Diseases of the skin* are not very common; slight cases of eczema are seen, but rarely a severe one.

G. *Endemic diseases*—

Malarial affections do not exist.

Typhoid fever is rare owing to the excellent water supply and good drainage. Eight cases occurred last year: their origin is attributed to oysters sold by itinerant vendors in the street. (For an account of the epidemic, I must refer to my Annual Report for 1895.)

Diarrhoea is met with during the summer months, chiefly amongst visitors and infants.

Scarlet fever and diphtheria.—Stray cases occur, and often they are introduced by visitors. There has been no serious epidemic for some years past.

Endemic sore throat is frequently seen during the winter months. The influenza epidemics of the last few years generally took this form at Aberystwith.

Infantile mortality and senile decay account for a great number of the deaths amongst the inhabitants.

2. **The Vital Statistics** for the year 1900 were as follows:—

The Number of Births registered was 144 (82 males and 62 females), giving an annual birth-rate of 16·9 per 1,000 calculated on the census basis of 8,500.

The Number of Deaths registered as having occurred within the borough during the year was 117, the lowest number recorded in the decade. The annual death-rate calculated on an estimated population of 8,500, *i.e.* allowing for visitors, would be 13·8 per 1,000.

The number of the deaths at the different ages was as follows:—

Under 1 year, 18; over 1 year and under 5 years, 7; over 5

years and under 15 years, 4; over 15 years and under 25 years, 9; over 25 years and under 65 years, 40; over 65 years, 39; total, 117.

The number of deaths amongst infants under a year old was 18. This would represent an infant mortality of 125 per 1,000 births.

The common causes of death besides those due to infantile mortality and senile decay are:—bronchitis, pneumonia and pleurisy; heart disease; apoplexy; hemiplegia, various paralyses; cancer of the liver, stomach, peritoneum and uterus; sarcomata; cirrhosis of the liver and alcoholism; diarrhœa.

3. The system of **Drainage** adopted is that of water-carriage. The main sewer is to be carried to the junction of the two rivers near the mouth of the harbour, and will discharge its contents into mid-stream. The drainage is good, the only fault being insufficient ventilation. Several shafts have been erected during the spring months, and more will be carried out.

4. **The Water Supply.**—The town has a constant supply of one of the finest waters in the United Kingdom. The supply is equivalent to 50 gallons per head, and the storage capacity of the lake is sufficient to meet a five months' drought. The water is obtained from Lake Rheidol near the summit of Plinlimmon, whose height is 2,463 feet above sea-level, and its distance from the town 18 miles. The proportion of solid elements, 1·30 in 100,000, is a considerably smaller proportion than in the famous waters of Loch Katrine, etc."

(Signed) ABRAHAM THOMAS, M.O.H.

July 30th, 1896.

CONCLUSIONS.

Enough has been said about the climate of South Wales, and a few remarks may now be added on the prevalent diseases and on their relation to the climate. The reports of the medical officers of health, which have been cited, do not point to the existence of a large amount of disease, and in some districts the principal cause of death seems to be old age, but they all bear witness to the prevalence of rheumatism, and of the large class described as diseases of the respiratory organs. It will be seen that both at Cardiff and Swansea, pneumonia, bronchitis, and pleurisy are more common, and cause a larger mortality than in England and Wales generally.

Phthisis mortality is above the average at Cardiff and Llanelly, but below it at Swansea and the Mumbles and Fishguard, and at the other places the numbers are too small to admit of comparisons.

Sir Hugh Beevor, in his able address on the Declension of Phthisis,¹ shows that the mortality from this disease is exceedingly high in South Wales generally; that the proportion of deaths from phthisis to all causes of death is 10·4 per cent., one of the highest figures in the United Kingdom, and that between 25 and 35 it is still higher, rising to 39 per cent.

This has been attributed to various causes, by some to the want of nitrogenous food, by others to the cold, damp climate, causing diseases of the respiratory system, and also to living in damp houses, which many Welsh families do, but the fact of the large phthisis mortality must be admitted.

The remarkable reduction of phthisis at Swansea is attributed by Dr. Ebenezer Davies to the effects of drainage in drying the subsoil.

According to Dr. Walford, the most common causes of death among the adult population of Cardiff are phthisis, bronchitis, and pneumonia; at Tenby the greatest mortality is from phthisis, but pneumonia and bronchitis prevail largely, as also at Swansea and Aberystwith. Much of this prevalence may be attributed to the moist atmosphere due (1) to the soil; (2) to the heavy rainfall; and (3) to the large number of rainy days. My own experience has long taught me that there is something in the atmosphere and conditions of South Wales which specially favours the production of phthisis, as from no part of Great Britain have I seen so many cases, and I can only ascribe it to the damp surroundings, and except in a few favoured spots, to the diminished amount of sunshine. The atmosphere of South Wales would thus not seem to be suited to the treatment of many forms of disease, but from its mildness and equability it seems likely to prolong life amongst old people.

In conclusion, I have to thank my friends, Mr. J. E. Ollivant, M.A., Chancellor of the Dioceses of St. David's and Llandaff, and the late Mr. G. J. Symons, F.R.S., for much information and many valuable hints in the preparation of this Report.

¹ *The Declension of Phthisis.* The *Lancet*, April 15, 1899.

THE CLIMATE OF IRELAND

BY SIR JOHN W. MOORE, M.D., D.P.H., UNIV. DUBL.; F.R.MET.SOC.;
LATE PRESIDENT OF THE ROYAL COLLEGE OF PHYSICIANS OF IRELAND

IRELAND extends from $51^{\circ} 26'$ to $55^{\circ} 23'$ N. lat., and from $5^{\circ} 25'$ to $10^{\circ} 30'$ W. long. The Atlantic Ocean encircles the island, which has the form of an irregular rhomboid, the largest diagonal of which, from Torr Head (Antrim) in the north-east to Mizen Head (Cork) in the south-west, measures 302 miles. Another measurement, from Fair Head, or Benmore, in Antrim to Crow Head in Kerry, gives 306 miles as the greatest length. The greatest meridional length (from Malin Head, the extreme northerly point) is not more than 225 miles. The greatest breadth between the extreme points of Mayo and Down is 182 miles, but from Dublin to Galway Bay the breadth is only 120 miles, and the average breadth from east to west does not exceed 140 miles. Ireland is separated from the larger island of Great Britain by three offshoots from the Atlantic Ocean—the North Channel, which is only $13\frac{1}{2}$ miles in width between Torr Head and the Mull of Cantyre; the Irish Sea, 130 miles in width; and St. George's Channel, which has a width of 69 miles between Dublin and Holyhead, 64 between Kingstown and Holyhead, and only 47 miles between Carnsore Point, co. Wexford, and St. David's Head, Pembrokeshire. The total area of Ireland is 32,535 square miles, or 20,822,494 acres.

A great undulating plain stretches across the centre of Ireland, rising in places to 280 or 300 feet, and having an average elevation of 200 feet. From Dublin Bay to Galway Bay this plain stretches from shore to shore. Elsewhere it is interrupted by groups of mountains, which range themselves for the most part near the coast-line. In the south-west the mountains are in chains, running

south-west and north-east, and separated by long inlets of the sea, which form the far-famed and beautiful fiords of Kerry.

The central plain of Ireland rests for the most part on the carboniferous limestone, over which in several places there are remains of the upper carboniferous strata, or coal-measures. Here and there in the central plain the limestone crops to the surface, but elsewhere it is overlaid by boulder clay, the result of glacier action; by the sands and gravels of a by-gone shallow sea; or by the peat-bogs, which tell of ancient oak-forests and fir-woods which in time were killed by mosses and other peat-producing plants. Through evaporation from these water-soaked morasses or *bogs*, which, according to the estimate of the late Sir Robert Kane, M.D., cover 2,830,000 acres, or about one-seventh part of the entire surface of Ireland, the superincumbent atmosphere is rendered moist and cool. The vast peat-bog which occupies so much of the central plain of Ireland is called the Bog of Allen.

Mountainous districts are found in Donegal and Derry, Antrim Down, South Dublin and Wicklow, Waterford, Cork, Kerry, Limerick, Tipperary, West Galway, Mayo and Sligo. From Galway to Derry the geological formation of the mountains consists chiefly of metamorphosed Lower Silurian rocks, a division of the Palaeozoic strata between the Old Red Sandstone and the Cambrian layers. The Upper Silurian stratum, underlying the Old Red Sandstone, is found in a range of hills between Killary Harbour and Lough Mask in Connemara, the highest peak being Muilrea (2,688 feet). Rocks of the Cambrian age occur in Dublin, Wicklow and Wexford. The highest summit is Lugnaquilla (3,039 feet), composed of altered Silurian rocks lying on the granite. It is interesting to note that granite reaches the sea-level in the district extending from Dalkey to Blackrock, co. Dublin.

The mountains of Kerry, Cork and Waterford are built up of Old Red Sandstone in broad bands, the valleys being formed of narrow bands of carboniferous rocks. Macgillicuddy's Reeks, the loftiest range in Ireland, rise abruptly from the carboniferous limestone of the Killarney district, to attain in Carran-tual a height of 3,414 feet above the sea—this is the highest elevation in Ireland.

The inland summits of the southern half of the island consist of central cores of Silurian strata wrapped round with thick folds of Old Red Sandstone.

The Mourne and Carlingford Mountains probably belong to the Permian period, but consist largely of granite in various forms. The geology of East Derry and Antrim is very interesting. Triassic rocks are overlaid by the Oolitic or Jurassic and Cretaceous strata, the whole being extensively submerged by the great basalt flood which poured over the north-eastern counties, and reached the sea at the Giant's Causeway. This far-famed natural formation consists of a series of terraces composed of hexagonal basaltic pillars occasionally separated by bands of volcanic ash.

One of the most remarkable features about Ireland is its indented coast-line, especially in the west and south. This in many cases is attributed by Professor E. Hull, in his *Geology of Ireland*, to the chemical action of the sea-water on the limestone rocks. On the east coast these inlets have become largely silted up by sand, but in the south, west, and north they often form magnificent harbours, on the shores of which delightful health resorts either do or might exist.

Mineral springs, chiefly chalybeate, exist in the upper limestone in many parts of the country, particularly at Mallow in Cork, Castleconnell near Limerick, Lisdoonvarna in Clare, Swanlinbar in Cavan, Dunkineely in Donegal, Ballynahinch in Down, and Lucan near Dublin.

The mineral products of Ireland are coal, chiefly anthracite, the average quantity raised yearly being only 130,000 tons: peat or turf, used as fuel in most country districts; iron in immense quantities, which are unfortunately not available for want of proper fuel for smelting; gold, silver, lead and copper.

The soil is naturally fertile, composed largely of detritus carried down to the plains from the varied mountain strata. Strong retentive clay, sand, chalk, and gravel soils are almost wholly absent. Notwithstanding these advantages, Irish agriculture remains in a backward and unsatisfactory state, partly as a result of the uncertainty of the climate, but much more from economic considerations.

In 1672 Sir William Petty estimated the population of Ireland at 1,320,000 persons.

In 1824 it was 7,078,140 persons, 3,471,820 being males and 3,606,320 females. In 1845 it had increased to 8,295,061 persons, of whom 4,083,043 were males and 4,212,018 were females. Then came the famine years, pestilence, and emigration, with the result

that when the census of 1851 was taken the total population had fallen to 6,514,473, the males numbering 3,181,353, and the females 3,333,120. The subsequent changes are best seen by a tabular statement of the results of each decennial census, and of the estimated population to the middle of the year 1901 :—

Census.	Total Population.	Males.	Females.
1861	5,788,415	2,831,783	2,956,632
1871	5,398,179	2,630,782	2,767,397
1881	5,145,770	2,519,219	2,626,551
1891	4,681,248	2,307,331	2,373,917
1901	4,443,370	2,192,397	2,250,973

CHIEF FEATURES OF THE CLIMATE OF IRELAND.

The claims of Ireland on those who are in search of health, of rest, of novelty in the midst of beautiful surroundings, are becoming more and more recognized every year. No matter in what direction the traveller wends his way through the Emerald Isle, he will find much to interest and instruct, to charm and delight. Apart from the scenery which bewitches by its infinite variety, Ireland presents an unrivalled field for archaeological, legendary, historic, botanical, and geological research. Its mountain masses standing like sentinels along its coasts, while they do not tower above the snow-line like the mighty Alps, have a grandeur which is all their own. The stupendous cliffs of the western shores, the fiords of Kerry and of Donegal, the towering headlands of Antrim, the sandy or shingly beaches of the eastern coast, and the land-locked bays of the south present a never-ending kaleidoscope of scenic beauty. Even close to the capital the panoramic views from the Hill of Howth or from Victoria Park, Killiney, are unsurpassed in loveliness.

And now all this is brought within easy reach, in regard to both time and money, by the enterprise of the various steamship and railway companies; while the creature comforts of the traveller are provided for in excellent hotels, which have sprung up in all directions along the main routes of tourist traffic throughout the country.

In choosing a health resort, one naturally asks whether such a place is more suitable for summer than for winter residence, or the converse; and again, what places have a relaxing, what a bracing climate. In order to answer these questions so far as they relate to Ireland, it will be necessary briefly to discuss the climate of this western island.

The following general conclusions, arrived at by Mr. F. Campbell Bayard in a paper read before the Royal Meteorological Society on June 15, 1892,¹ apply to Ireland as well as to Great Britain. Mr. Bayard finds that—

(1) With respect to *mean temperature*, the sea-coast stations are warm in winter and cool in summer, whilst the inland stations are cold in winter and hot in summer.

(2) The *mean maximum temperature* occurs at all stations in July or August, while the *mean minimum temperature* takes place mostly in December or January, except at Llandudno and the south-western coast stations, where it is later, taking place in February or March.

(3) *Relative humidity* (or the percentage of saturation of the air with aqueous vapour) is lowest at the sea-coast stations and highest at the inland ones.

(4) The south-western district seems to be the most *cloudy* in winter, spring, and autumn, and the southern district the least cloudy in the summer months; further, the sea-coast stations are, as a rule, less cloudy than the inland ones.

(5) *Rainfall* is smallest in April, and, as a rule, greatest in November, and it increases as we travel from east to west.

The temperature of the sea which washes the Irish shores has a far-reaching influence upon the climate of this country. In January we find a mean sea-temperature as high as 44·6 at Cleggan, co. Galway, and even at the Kish Lightship, 9 miles off Kingstown Harbour, it is 44·0 compared with 37 at Yarmouth and Berwick. In July, on the contrary, the mean sea-temperature at the Kish Lightship is 56·3, or 4 below the mean temperature of the air in Dublin (60·3).² From these figures it is clear that the proximity of the sea is a source of warmth in

¹ *Quarterly Journal of the Royal Meteorological Society*, New Series, vol. xviii. No. 84, p. 213. See also *Meteorology Practical and Applied*, by J. W. Moore, M.D., F.R.Met.Soc. London: Rebman, 1894. P. 334, *et seq.*

² For further details see pp. 334 and 335.

winter and of coolness in summer. The isothermals (see diagram p. 335) indicative of the mildest British climate in winter are seen enveloping Ireland in January. Dr. A. Buchan points out that in that country the lowest temperature in winter is in the interior towards the north-east, or lee side, of the island, and from this central area, where the mean in January does not exceed 40·0 F. (4·4 C.), temperature rises all round, but especially towards the south-west, on advancing in which direction it rises successively to nearly 45·0 F. (7·2 C.). In the summer months the warmest portion of Ireland is the south-east, and the isotherms there follow a course more nearly north and south than east and west: as do those over the west of Great Britain, particularly to the north of the Solway. A tendency to *northing* of the summer winds also plays an important part in the peculiar distribution of temperature as shown in the disposition of the isotherms over the west of Ireland in summer.

The actual facts are as follow:—In January, the isotherm of 40 embraces an oval-shaped area extending from the western, or inland, half of Antrim southwards to the counties Kilkenny and Carlow. The isotherm of 41 passes through Dublin south-westwards to Fermoy, and then curves towards north-west and finally north to the extreme north of the island near Lough Swilly. On the other hand, the isotherm of 45 sweeps southwards down the extreme western coast from Achill Island to Valentia. In July, the isotherm of 58 skirts the north and that of 59 the west coast, while that of 60 embraces a large area extending from Upper Lough Erne southwards towards Cork. Tipperary and North Cork, with Kilkenny and Carlow, enjoy a mean temperature of 62. The great Central Plain extending from Galway to Dublin is somewhat cooler—60·4 to 60·8. This is, doubtless, due to the immense quantity of water with which the Bog of Allen and other less extensive peat-bogs are charged, as well as to the number of lakes in the centre and west of the country.

The smallest annual rainfall in the British Isles is at Spurn Head, Yorkshire, 19·1 inches, and at Shoeburyness, in Essex, where the average for 25 years was only 20·6 inches. The only part of Ireland where the rainfall falls decidedly short of 30 inches is Dublin and its vicinity (about 28 inches).

The highest rainfall in Ireland is 86 inches, on Mangerton, a

mountain near Killarney, but is based on only eight years' record. At Kylemore, in Connemara, the mean for 15 years is 77·6 inches, for a similar period at Dromore Castle on the Kennmare river, co. Kerry, it is 60·2 inches. Derreen, Bantry and Dunmanway in the south-west of the co. Cork, have a mean yearly rainfall over 60 inches. The highest rainfall in the north-west is recorded at Killybegs, on Donegal Bay, 57 inches; and in the east, the highest is 50·6 inches at Newcastle, co. Down.

In addition to the Dublin stations, which, as we have just seen, have a rainfall of about 28 inches, Dr. Buchan gives Dundalk (on an average of ten years) as having an annual fall under 30 inches (29·9 inches).¹

CLASSIFICATION OF IRISH HEALTH RESORTS.

With the above facts before us, we are in a position to roughly classify the Irish health resorts according as they are suitable for summer or winter residences, and according as they are dry, bracing and cool, or humid, relaxing and warm. As **summer resorts**, the watering-places on the north and east coasts are most suitable, such as Buncrana, Portstewart, Portrush, Ballycastle, Carnlough, Whitehead, Bangor, Donaghadee, Ardglass, Newcastle, Greenore, Laytown, Balbriggan, Skerries, Malahide, Howth, Kingstown, Dalkey, Killiney, Bray, Greystones, Wicklow, Courtown Harbour, and Rosslare. To this list may be added Youghal on the south coast and Kilkee in co. Clare, as well as Doogort in Achill Island, Enniscrone in co. Sligo, and especially Bundoran, near the southern border of co. Donegal. All these watering-places will be more fully described later on.

As **winter resorts**, Newcastle, co. Down, Rostrevor and Warrenpoint on Carlingford Lough, Sutton near Howth, Monkstown, co. Dublin, Kingstown, Killiney and Ballybrack, Bray, Greystones, Queenstown, Glengariff, Parknasilla, co. Kerry, Salthill near Galway, Mallarany on Clew Bay; and, as inland stations, Dundrum and Lucan, co. Dublin; Delgany and Enniskerry, co. Wicklow, and St. Ann's Blarney, may be mentioned.

Speaking in general terms, *the stations in the south and south-*

¹ For a graphic representation of the general rainfall of the Island, see the Rainfall Map on p. 128.

west of Ireland are more or less relaxing, particularly those situated at a short distance from the open sea, such as Queenstown, Glengarriff and Kenmare. Nevertheless, there are many invalids who do remarkably well at either Queenstown or Glengarriff. With regard to the former, the steepness of the hill upon whose southern slope it stands should be taken into account. On the other hand, Queenstown is more open, less surrounded by trees, and infinitely more stirring than Glengarriff. Both places are ideal spring resorts.

Among the most bracing watering-places in Ireland are Bundoran, co. Donegal; Portrush, co. Antrim; Donaghadee and Newcastle, co. Down; Kingstown, Greystones, and Kilkee.

We may now pass to a more detailed consideration of the Irish health resorts, and preface their description by a short account of Dublin and its climate.

DUBLIN.

Dublin, the metropolis of Ireland, stands at the extreme western end of the beautiful Bay of Dublin, close to the mouth of the river Anna Liffey, along both north and south banks of which the city extends for a distance of some 2 miles. It is 292 miles in a direct line west-north-west of London, 138 miles west of Liverpool, and 69 miles west of Holyhead, and is situated in lat. $53^{\circ} 20' N.$, long. $6^{\circ} 17' W.$ It comprises an area within the municipal boundary of 7,894 acres, containing in 1901 a population of 290,837. But these figures by no means represent what may be called "Greater Dublin," or the Dublin Registration District. This consists not only of the city proper, but also of the populous suburban districts of Rathmines, Pembroke, Blackrock, and Kingstown. The population of this "Greater Dublin" was, in 1901, 375,076: and its extent is 24,693 statute acres.

The origin of the city is lost in the mists of antiquity. The Greek geographer Ptolemy, writing A.D. 140, speaks of a small tribe, the Eblani, as having established themselves at Eblana ("Civitas Eblana"), which was probably the site of Dublin. The dark peat-stained waters of the Anna Liffey gave its present name

to the Irish capital, for the Celtic *Duibhlinn* signifies the "black pool." Among the Irish-speaking population of the west of Ireland, Dublin retains its ancient name of Ath-Cliath, or more fully Bally-ath-cliath, the Celtic *Baile-atha-cliath* meaning the "town of the ford of the hurdles." From this name the obvious inference is that a wickerwork causeway stretched across the Liffey, and that in its vicinity the town sprang into existence.

The site of Dublin was originally not only beside a pool of dark water (*Duibhlinn*) but in a swamp, for the prefix "Anna" in the name *Anna Liffey* signifies literally a watery place, a marsh or swamp, annagh (*canach*) being derived from *can*, water. It is this untoward circumstance, perhaps, which in modern times has gained for Dublin so evil a reputation for the endemic prevalence of typhoid fever, and for a susceptibility in summer and autumn to diarrhoeal—or, as they are well termed, "filth-diseases." In 1888, the late Dr. T. W. Grimshaw, C.B., Registrar-General for Ireland, in conjunction with Sir Charles A. Cameron, C.B., Medical Superintendent Officer of Health for the city of Dublin, read before the State Medicine Section of the Royal Academy of Medicine in Ireland a paper on the distribution of enteric fever in this city. The authors found that the fever was particularly prevalent in districts situated on pervious strata of the soil and subsoil. The rate of prevalence of enteric fever among the residents on the pervious strata was 6·82 per 10,000 per annum, while on the impervious strata it was only 4·6. One death from enteric fever occurred in every 365 inhabitants residing on the pervious strata, but one such death only in every 531 inhabitants dwelling above the impervious strata.

The pervious stratum consists of a sand and gravel bed formed by an old raised sea-beach, which occupies the centre of the city along both sides of the river Liffey, into which all the city sewage has hitherto been discharged. This gravel bed rests on clay and rock, so that it retains all the fluid filth cast upon it, or which has soaked into it from the river. At the time of writing, a costly and extensive system of main drainage is in process of construction. By this the gravel bed will be effectually drained, with, no doubt, a highly beneficial effect upon the health of the city, especially in respect to the prevalence of, and fatality from, "filth-diseases."

Dublin is a handsome, and in parts a picturesque city. Many of the public buildings can lay claim to considerable architectural beauty, the principal thoroughfares are for the most part broad and straight. The city is well supplied with "lungs" in the splendid squares on both north and south sides of the intersecting river. One of the largest of these open spaces is the ancient and far-famed University of Dublin with its quadrangles and far-stretching gardens and College Park. The grave defect which does much to neutralize the beneficial effect of the situation and surroundings of the capital upon public health, is the housing of the poorer classes. The residential houses in the older parts of the city, especially in the Coombe district and the "Liberties," have long since been broken up into tenements. These are the dwelling-places of a large proportion of the poorer inhabitants, and so have come to play a ghastly part in the "bills of mortality" for generations. From their structure, age, and insanitary state these tenement houses are unwholesome to the last degree, and all sanitary reformers agree that the housing of the poor is one of the most pressing questions of the day in Dublin.

Much has been done of late years to abate the crying evil of the Dublin tenement houses—witness the splendid work of the Dublin Artisans' Dwellings Company, of the Corporation of Dublin, and last, not least, of the Guinness Trust, which has given living expression to the philanthropy and princely munificence of the Right Hon. Lord Iveagh, K.P. A further movement is on foot at present to provide sanitary accommodation on very reasonable terms for even the very poor among the industrious and sober classes of the population.

From a hygienic standpoint, the meteorological factors of greatest importance in determining the climate of a given town or place are—(1) Mean Temperature; (2) Extremes of Temperature; (3) Rainfall; (4) Rainy Days; and (5) Relative Humidity. Of somewhat less importance are—(6) Mean Atmospheric Pressure; (7) Amount of Cloud; (8) Direction and Force of the Wind.

Mean Temperatures.—Dr. Alexander Buchan has calculated the mean monthly and annual temperature of the City of Dublin on a mean of forty years, from January 1856 to December 1895. His results are as follows:—

January	= 41·1	July	= 60·3
February	= 42·0	August	= 59°·4
March	= 43·3	September	= 55·6
April	= 47·3	October	= 49·4
May	= 52°·3	November	= 44°·5
June	= 57·5	December	= 41·6

Year = 49·5

Extreme Temperatures.—Since January 1865, the extreme readings of the thermometer in Stevenson's stand recorded in Dublin have been 87·2 on July 15, 1876, and 13°·3 on December 14, 1882—a range of 73°·9 Fahr. But these values are very exceptional. The average annual range of mean temperature is not quite 20—viz. January, 41·1; July, 60·3—that is, 19·2 F.

Rainfall.—In the "Rainfall Tables of the British Islands, 1886–1890," published by the authority of the Meteorological Council in 1897, the mean rainfall at Fitzwilliam-square, Dublin, is given for the 20 years, 1871–1890, as follows:—

	Inches.		Inches.
January	= 2·09	July	= 2·63
February	= 2·22	August	= 2·91
March	= 1·97	September	= 2·23
April	= 2·16	October	= 3·18
May	= 1·89	November	= 2·70
June	= 1·98	December	= 2·35

Total for the year = 28·31 inches.

The "rainfall" is the measurement at 9 a.m. each day, and is entered to the day preceding, to which 15 of the previous 24 hours belong. A "rainy day" is one on which at least five-thousandths (·005) of an inch falls within the 24 hours from 9 a.m. to 9 a.m. In the twenty years, 1865 to 1884, the average monthly and yearly number of rainy days in Dublin was:—

January	= 17·1	July	= 17·6
February	= 17·6	August	= 15·5
March	= 16·5	September	= 14·5
April	= 15·0	October	= 17·2
May	= 15·1	November	= 16·8
June	= 14·7	December	= 17·0

Total for the year = 194·6.

Borrowing the language of the agriculturist, we may roughly regard the first quarter of the year (January–March) as "Seed-time," the second quarter (April–June) as "Growing-time," the

third quarter (July–September) as “Ripening and Harvest-time,” and the fourth quarter (October–December) as “Fallow-time.” We find then that the average precipitation in “Seed-time” amounts to 6·28 inches, distributed over 51·2 days; that in “Growing-time” is 6·03 inches, on 44·8 days; that in Ripening-time” is 7·77 inches, on 47·6 days; and that in “Fallow-time,” is 8·23 inches on 51·0 days.

February 1891 was the driest month on record in Dublin. There were only 2 rainy days during the whole month, and the rainfall was but ·042 inch. September 1865 also had only 3 rainy days, with a rainfall of only ·056 inch. The mean temperature of the latter month was 61·4, or 5·8 above the average (55·6) for September.

On the other hand, December 1876 had a rainfall of 7·566 inches on 22 days. In October 1880 also 7·358 inches of rain fell, on however but 15 days—the precipitation on the 27th alone was nearly *two and three-quarter inches* (2·736). In July of the same year, 6·087 inches of rain fell on 24 days. In November 1888 the rainfall was 6·549 inches on 26 days. The *wettest* month—that is, the month in which there were most rainy days—was July 1871, when 4·391 inches fell on no less than 28 days.

An inch of rain—equivalent to a downpour of 101 tons of water on every statute acre—seldom falls within 24 hours in Dublin. On six occasions, however, since 1865—that is in 35 years, more than 2 inches of rain have been measured in this city, and on October 27, 1880, the measurement was 2·736 inches.

The comparatively small precipitation in and near Dublin clearly depends on the geographical surroundings of the Irish capital—its situation in the east of the island, and the grouping of high lands to the south-east, south, and south-west, whereby the rainbearing winds are drained of their superabundant moisture before they reach the valley of the Liffey and the plains lying north of that river.

Relative Humidity.—By this term is meant the percentage of saturation of the atmosphere with aqueous vapour. The relative humidity of absolutely dry air is 0, that of saturated air, when dew is deposited or fog forms, is 100. In Dublin the

mean relative humidity in the twenty years, 1871–1890, was 82·5 per cent. (81·2 per cent. at 9 a.m. and 83·8 per cent. at 9 p.m.). It is highest on an average in December (86·7 per cent.) and lowest in May (76·2 per cent.)—this latter being the month when temperature is rising most quickly, and when, therefore, the capacity of the air for aqueous vapour is at a maximum.

Mean Atmospheric Pressure.—Dr. Alexander Buchan calculates the mean monthly and yearly atmospheric pressure, reduced to 32° and mean sea-level, in the City of Dublin during the 40 years—1856 to 1895 inclusive—to be:—

	Inches.		Inches.
January	= 29·870	July	= 29·931
February	= 29·923	August	= 29·903
March	= 29·885	September	= 29·919
April	= 29·914	October	= 29·867
May	= 29·956	November	= 29·876
June	= 29·981	December	= 29·887
Annual Mean = 29·909 inches.			

From this table it appears that the monthly mean pressure rises to 29·981 inches in June, and falls to 29·867 inches in October. I may state that the absolute extreme readings of the barometer at any time taken by me were—maximum, 31·020 inches, at 10 a.m. of January 9, 1896; minimum 27·758 inches at 2·30 p.m. of December 1886. These readings assuredly represent the extreme range of atmospheric pressure, reduced to sea-level, in Dublin—namely, 3·262 inches, rather more than 3¼ inches.

Amount of Cloud.—This climatological element varied in the 20 years, 1871–1890, from 64·5 per cent. at 9 a.m. to 56·5 per cent. at 9 p.m., the mean being 60·5 per cent. February is the most cloudy month (67 per cent.), May is the least so (55 per cent.). The clearness of the sky at 9 p.m. in May is a striking characteristic of the meteorology of that month.

Direction of the Wind.—As regards this element, 14,613 observations were made during the 20 years, 1871–1890, with this result—N., 870; N.E., 941; E., 1,409; S.E., 1,267; S., 1,323 S.W., 2,051; W., 4,030; N.W., 1,750; calm, 972.

The preponderance of westerly (south-west to north-west) over easterly (north-east to south-east) winds is very striking; the

figures are 7,831 and 3,617 respectively, more than two to one in favour of westerly winds. But the great excess of due west winds is still more remarkable. They number 4,030, or nearly double the number of south-west winds, 2,051. Partial deflection of south-west winds by a range of mountains with summits of 2,000 feet and upwards, to the southward of the city, in some measure accounts for this: and a further explanation is to be found in the frequent occurrence of light westerly land breezes during calm, cold weather in winter. Correlated to this class of westerly winds are the light easterly and south-easterly sea-breezes of the day-time which so materially modify the heats of summer in Dublin, and go so far to swell the number of east and south-east winds included in the table.

Gales were recorded on 413 occasions at 9 a.m. or 9 p.m. within the twenty years. Of these 171, or considerably more than one-third, happened within the first quarter of the year, only 38 in the second, 56 in the third, and 148 in the fourth. January (with 74 gales) was the stormiest month. There were only 4 gales in June.

Thunderstorms occurred on 176 days, of which 13 were in the first quarter, 62 in the second, 78 in the third, and 23 in the fourth. June (with 34 storms) and July (with 50) were the months in which electrical disturbances most frequently took place. Only one thunderstorm occurred in December during the twenty years.

There were 408 days upon which *snow* or *sleet* was noted. Of these 258 fell in the first quarter, 36 in the second, none in the third, and 114 in the fourth. Of 622 days on which *hail* was recorded, 255 were found in the first quarter, 160 in the second, 40 in the third, and 167 in the fourth. The relative frequency of hail in the warmer months is noteworthy.

The climate of Dublin is, in the fullest sense, an *insular* one, free from extremes of heat and cold—except on very rare occasions—and characterized by a moderate rainfall (about 28 inches) annually, which is distributed however over a large number of days (about 195 in each year). Clouded skies, a high degree of humidity, and a prevalence of brisk winds—chiefly from westerly points of the compass—make up the climatology of the Irish capital.

In common with the rest of the British Islands, Dublin owes its mild equable climate in great measure to the proximity of the North Atlantic Ocean and its surface current of warm water, usually called "The Gulf Stream," because its head-springs arise in the Gulf of Mexico. This sets in a north-easterly direction, laving in its course the western shores of Europe, and carries even into the Arctic Regions north of Scandinavia temperatures from 20° to 30° above those due to the latitude alone.

Another obvious cause of the mildness of the climate is the overwhelming prevalence of south-westerly and westerly winds, which are both warm and moist. These winds have been shown to form part of a cyclonic circulation round a large area of low atmospheric pressure, the centre of which in winter lies not far from Iceland over the North Atlantic. Only in spring do these periodic winds give place to northerly and easterly breezes.

But local natural advantages as regards situation exercise a further beneficial effect on the climate of Dublin. A few miles south of the city lies a range of mountains, with summits varying in height from 1,000 to more than 2,500 feet. This mountain chain intercepts the vapour-laden winds at all points between south-south-east and south-west, and so the rainfall is diminished and the sky is comparatively cleared during the continuance of the southerly and south-westerly winds, which so frequently prevail. The absence of any very high ground to the northward of the city—with the exception of the Hill of Howth, which rises however only to 563 feet—also prevents excessive precipitation with south-west winds. It is true that with easterly (south-east to north-east or north) winds the precipitation (often in the form of hail, and in winter of sleet or snow) in and about Dublin exceeds that which occurs at such a time inland or on the Atlantic coasts. Were it not for this "lee-shore" condensation the Dublin rainfall would be considerably smaller even than it is.

The second local feature which ameliorates the climate of the capital is the proximity of the sea to the eastward of the city. The keen, dry, searching easterly winds of winter and spring are much softened in their passage across the Irish Sea, so that during their prevalence the thermometer occasionally stands some 5° or upwards higher in Dublin than it does at Holyhead, although this latter place is actually on the sea. It is true that

the converse holds good during westerly and north-westerly winds, when severe frost sometimes occurs in winter in Dublin, while the thermometer remains decidedly above the freezing-point at Holyhead. Yet these latter winds are never so piercingly cold and parching as those from easterly points. Nor is it in winter merely that the Irish Sea confers a benefit upon Dublin. In calm, clear weather in summer time, no sooner has the sun mounted high in the heavens than a cool, refreshing sea-breeze—a typical “inbat,”¹ as the modern Greeks call it—sets in towards the land, so that consequently extreme or oppressive heat is rarely experienced. Indeed, an oppressive atmosphere happens only when a damp, warm south-west wind is blowing, with a more or less clouded sky. Temperatures above 80° in the screen in Dublin nearly always coincide with winds off the land, from some point between south and west, and a clear or only slightly-clouded sky.

Among climatic epiphenomena, the infrequency of thunderstorms and the relative frequency of hail-showers in Dublin are worthy of note. In winter, fog and frost often prevail in the city, when a northerly breeze is blowing along the coast, accompanied by a higher temperature, and perhaps showers of rain. Lastly, in summer, with a westerly wind, heavy planetary showers fall at times in the valley of the Liffey, while the neighbouring higher lands enjoy dry weather.

The health of Dublin is not all that should be desired. Its population shows little resistance to the poisons of the commoner infectious diseases and fevers. Seasonal maladies also, such as bronchitis and pneumonia in winter and spring, and diarrhoea in summer and autumn, prevail extensively and claim a long death-roll, particularly among the poorer classes. The following table compiled from the Returns of the Registrars-General for each division of the United Kingdom, contains information as to the death-rate from all causes, and its fluctuations through a long series of years. (See p. 397.)

The Water Supply of Dublin.—Dublin and its suburbs are fortunate in possessing an abundant supply of pure soft water, and the Dublin Corporation Water Works enjoy a reputation far and wide for completeness and efficiency.

The following account of the water works is abridged from

¹ Evidently a derivative from *ἐμβαίνω*.

TABLE SHOWING THE ANNUAL DEATH-RATE PER 1,000 LIVING IN CERTAIN LARGE TOWN-DISTRICTS OF THE UNITED KINGDOM AND IN DUBLIN CITY AND DUBLIN SUBURBS; FOR EACH OF THE YEARS 1881-1898, WITH THE AVERAGE ANNUAL RATE OF MORTALITY FOR EACH OF THE FIVE-YEAR PERIODS 1871-1875, 1876-1880, 1881-1885, 1886-1890, AND 1891-1895.

ANNUAL DEATH-RATE PER 1,000 LIVING.																								
	Aver- age 1871- 80.	Aver- age 1876- 80.	1881.	1882.	1883.	1884.	1885.	Aver- age 1881- 85.	1886.	1887.	1888.	1889.	1890.	Aver- age 1886- 90.	1891.	1892.	1893.	1894.	1895.	Aver- age 1891- 95.	1896.	1897.	1898.	
Dublin District.	29.3	31.6	26.5	27.3	28.5	27.4	28.0	27.5	26.5	30.2	24.8	25.3	26.3	26.6	25.5	28.4	26.0	23.8	27.0	26.1	24.5	28.1	27.8	27.8
Dublin City . . .	31.6	34.0	29.2	30.4	31.8	30.3	31.2	30.6	29.0	33.0	27.3	28.6	29.0	29.3	28.5	31.0	29.1	26.6	30.1	29.2	27.4	31.6	28.5	28.5
Dublin Suburbs.	21.5	23.3	19.4	19.3	20.4	20.3	19.0	19.9	20.6	21.1	19.0	17.4	19.0	19.6	18.5	20.2	18.7	17.2	20.0	18.9	17.9	19.0	19.6	19.6
London	22.9	22.2	21.3	21.3	20.8	20.9	20.4	21.0	20.6	20.3	19.3	18.4	21.4	20.0	21.5	20.7	21.3	17.7	19.8	20.2	18.6	18.2	18.7	18.7
Edinburgh . . .	25.1	21.3	19.6	19.2	18.9	20.0	18.6	19.3	19.7	20.3	18.7	18.8	20.9	19.7	21.6	19.4	19.7	17.5	20.8	19.8	16.9	21.3	19.6	19.6
Glasgow	30.5	26.7	25.2	25.2	27.8	26.4	25.3	26.0	24.3	22.3	21.2	23.6	23.8	23.0	25.3	22.8	23.3	19.9	23.5	23.0	20.4	22.0	21.2	21.2
Liverpool . . .	29.5	27.4	26.8	27.1	27.8	26.7	25.7	26.8	26.1	26.5	23.1	25.0	27.8	25.7	27.0	24.7	27.3	23.8	28.8	26.3	22.7	24.4	24.0	24.0
Manchester . . .	30.6	28.6	25.4	26.5	27.3	25.9	25.8	26.2	25.9	28.1	25.5	26.1	29.7	27.1	26.5	23.8	24.9	20.4	25.2	24.2	22.6	23.1	21.9	21.9
Birmingham . .	25.3	23.0	20.0	21.2	21.7	22.0	20.0	21.0	20.8	20.8	18.9	20.1	22.4	20.6	22.2	20.4	22.0	18.6	20.3	20.7	20.8	21.6	20.6	20.6
Belfast	—	—	23.0	25.2	25.7	22.8	27.0	24.0	22.7	24.5	23.8	24.0	27.3	24.5	25.5	26.5	25.8	24.6	26.2	25.7	25.1	25.7	25.5	25.5
Cork	—	—	26.2	24.3	25.2	27.2	26.8	25.0	22.8	23.2	25.2	23.4	23.4	23.6	26.0	26.4	24.5	24.0	23.0	25.3	22.6	24.7	23.7	23.7

1 Exclusive of deaths of persons admitted into public institutions from other districts.

NOTE.—The figures for Dublin District, City, and Suburbs for the years antecedent to 1879, denote the recorded death-rate with the addition of ten per cent. to allow for deficiency of registration prior to the introduction of the "Burial Returns."

the description written in 1875 by the Engineer, Mr. Parke Neville, C.E., M.I.C.E., F.R.I.A., M.R.I.A., and published by Mr. John Falconer, 53 Upper Sackville Street, Dublin. For the more recent information I am indebted to Mr. Spencer Harty, C.E., the City Surveyor and Water Works Engineer, and Mr. Charles Power, Secretary to the Water Works Committee of the Corporation. Both gentlemen spared neither trouble nor time in answering certain queries which I addressed to them with the view of making this description as complete and accurate as possible.

In August 1860, Mr. (afterwards Sir John) Hawkshaw visited Dublin as a Royal Commissioner to examine into all the schemes at the time proposed for improving the water supply of the Irish metropolis. In his Report, dated October 20, 1860, Sir John Hawkshaw expressed the opinion that the then existing supply of water to the city of Dublin was bad, that there was urgent need of an improved supply, and that the best source from which such could be obtained was the river Vartry in the co. Wicklow. The Vartry scheme had been in the first instance suggested by Mr. Richard Hassard, C.E.

After a severe Parliamentary contest the Dublin Corporation Water Bill, based on the Royal Commissioner's recommendations, obtained the Royal assent on July 21, 1861. The first stone of the water works was laid at the Prince of Wales' Reservoirs, Stillorgan, by the Earl of Carlisle, Lord Lieutenant of Ireland, on November 10, 1862. The water of the river Vartry was turned from its ancient course through a tunnel under the main embankment of the great storage reservoir near Roundwood, co. Wicklow, on June 10, 1863, when the Lord Lieutenant (Lord Carlisle) conferred the honour of knighthood on Sir John Gray, M.D., Chairman of the Dublin Corporation Water Works Committee. It was not however until 1868 that the Vartry water was supplied to Dublin and its suburbs on the completion of the works.

The river Vartry rises on Calary Moor, co. Wicklow, at the base of the Djouce Mountain and of Great Sugar Loaf Mountain, whence it flows in a southerly direction through a thinly-peopled district to the Devil's Glen. Passing as a mountain torrent through this beautiful wooded valley, it flows by the village of Ashford, finally reaching the Broad Lough, as the lagoon inside the Murrow of Wicklow is called, and discharging into the sea at

the town of Wicklow. The length of the river from its rise to the sea is $17\frac{1}{2}$ miles, and its catchment area is 34,890 acres. The geological formation of this area is the lower Silurian and Cambrian slate, except on the hill-tops towards the west, where the granite crops out in spots. The Vartry water is peculiarly soft and pure, quite colourless during the greater part of the year. In a word it closely resembles Loch Katrine water, with which Glasgow is supplied. The catchment area draining into the river above the water works is 14,080 acres.

Fortunately for the success of the scheme the rainfall in the Vartry district was under-estimated. No rain-gauges existed prior to 1860. It was calculated that, allowing for loss by evaporation and absorption, 14·3 inches would remain for the supply of Dublin, and that this over the catchment area of 14,080 acres would equal 12,000,000 gallons a day, or 25 gallons a head for a population of 400,000, with 2,000,000 for manufacturing purposes. Since 1860 several rain-gauges have been in action in the district.

The following tables have been compiled from the official returns:—

TABLE I.

SHOWING THE YEARLY RAINFALL AT VARTRY LODGE, ROUNDWOOD, CO. WICKLOW, FOR EACH OF THE FORTY YEARS, 1861–1900.

	Inches.		Inches.		Inches.		Inches.
1861	60·86	1871	51·65	1881	55·52	1891	49·04
1862	60·65	1872	69·34	1882	57·45	1892	44·63
1863	45·09	1873	40·01	1883	61·52	1893	33·74
1864	47·76	1874	42·50	1884	39·16	1894	67·13
1865	48·69	1875	61·75	1885	47·82	1895	54·07
1866	53·43	1876	61·27	1886	49·91	1896	51·14
1867	46·05	1877	64·80	1887	31·91	1897	63·58
1868	56·15	1878	43·15	1888	60·13	1898	52·51
1869	49·00	1879	53·07	1889	47·34	1899	42·71
1870	43·68	1880	53·78	1890	47·02	1900	50·46
Decennial Means, 1861–1870.	Inches. 51·14	Decennial Means, 1871–1880.	Inches. 54·14	Decennial Means, 1881–1890.	Inches. 49·78	Decennial Means, 1891–1900.	Inches 50·90.

The foregoing figures clearly show within what wide limits the precipitation in the Vartry Catchment Basin varies from year to year. In 1872 the rainfall amounted to 69·34 inches. In 1887 it

TABLE II.
SHOWING THE MONTHLY AND YEARLY RAINFALL AT VARIETY LODGE, ROUNDWOOD, CO. WICKLOW, FOR THE FOLLOWING
FIFTEEN YEARS.

	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	Means.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January . .	4.21	5.07	3.01	3.25	4.85	4.91	6.98	0.03	2.12	7.72	7.45	6.38	1.19	6.95	3.88	4.70
February . .	11.20	6.51	6.21	1.85	1.37	3.65	2.05	0.23	1.61	5.13	4.15	1.80	2.71	3.00	2.57	3.80
March . . .	5.18	3.72	3.41	2.78	8.50	3.08	5.01	1.66	1.49	1.15	3.06	4.57	3.81	7.83	1.92	3.81
April . . .	3.39	5.28	2.80	1.49	2.61	3.49	2.67	3.63	1.66	0.44	7.51	3.18	0.77	6.47	4.82	3.35
May . . .	2.14	3.26	6.81	1.76	3.66	4.65	4.30	4.00	4.65	0.77	7.08	0.54	0.09	1.12	7.04	3.46
June . . .	0.59	1.07	1.43	0.15	4.52	0.29	3.00	5.49	3.98	1.92	2.61	1.80	2.81	4.77	3.30	2.52
July . . .	3.65	0.73	3.84	1.47	8.16	2.29	2.57	1.83	3.69	2.02	6.31	5.68	6.89	1.70	1.47	3.49
August . . .	0.53	1.90	1.93	4.01	3.09	5.92	3.41	4.98	4.64	3.96	5.36	6.94	1.56	8.73	4.81	4.30
September .	1.74	4.52	3.28	2.88	0.50	2.08	3.27	2.75	3.91	1.05	1.62	1.43	11.52	4.44	2.57	3.17
October . .	0.70	6.32	5.57	2.71	3.35	11.03	1.44	7.63	5.43	1.57	10.53	2.69	6.11	5.67	8.81	5.31
November .	2.53	5.06	6.79	6.61	11.26	2.16	7.89	7.45	6.71	3.34	6.76	10.30	1.84	6.31	8.12	6.21
December .	3.30	1.38	4.83	2.88	8.21	3.79	4.42	7.66	1.68	4.67	4.69	8.26	11.81	6.59	3.17	5.16
TOTALS . .	39.16	47.82	49.91	31.90	60.11	47.34	47.01	47.04	44.60	33.74	67.13	53.57	51.14	63.58	52.51	49.28

reached 31·91 inches only. The average rainfall for the fifteen years included in Table II. (p. 400)—1884–1898—was 49·28 inches. For the whole series of 40 years the average annual rainfall was 51·49 inches—a figure which may be regarded as final.

The great storage reservoir stands about $7\frac{1}{2}$ miles from the source of the Vartry river and $1\frac{1}{2}$ miles south-east of the village of Roundwood. When filled to the level of the bywash, the water in the reservoir covers 409 acres, the greatest depth being 60 feet and its mean depth 22 feet. Its surface is 692·45 feet above Ordnance datum (low-water of a 12-foot tide at the Poolbeg Lighthouse, Dublin Bay). The storage capacity of the reservoir or Lough Vartry is about 2,400,000,000 gallons, equal to 200 days' supply for the city of Dublin and its suburbs at the rate of 12,000,000 gallons a day.

The water leaves the reservoir through three 24-inch valve inlets at different levels in a turreted water-tower connected with a 33-inch pipe, which passes through a tunnel some 300 feet in length under the great eastern embankment. At the far side the water is carried into a series of filtering-beds, and thence into two pure water-tanks. From these last the water is conveyed to a tunnel 4,332 yards in length, through which the water is carried through the valley of the Vartry under a range of hills, averaging 1,000 feet in height, dividing it from the districts towards the east. Great difficulties were met with in driving this wonderful tunnel of over 3 miles in length. The chief of these were the hardness of the rock, which was of the lower Cambrian or Silurian system, the irregularities of the stratification and the thinness of the layers, which were frequently horizontal, and the quantity of water met with in the borings. The tunnel was driven from 21 shafts, each 200 yards apart. The first shaft was commenced on January 4, 1863, and the last heading was opened out in September 1866, the total time taken to drive the tunnel being thus three years and eight months.

At the northern end of the tunnel, at Callow Hill, a cast-iron gauge weir has been erected for registering the quantity of water passed down for the metropolitan supply. The water is measured six times daily by a floating meter. From a tank, 86 feet in diameter and 10 feet deep, the water is conveyed from a level of

602 feet above Ordnance datum through a 33-inch main to the service reservoirs at Stillorgan. The length of this main is 30,942 yards, or 17 miles, 4 furlongs, and 142 yards, and the falling hydraulic line is 20 feet per mile. Three relieving tanks to diminish the pressure are constructed on the line of main—at Kilmurray (473 feet), Kilerony (414 feet), and Rath-michael (341 feet), the last distant 7,431 yards from the Stillorgan reservoirs.

The three distributing reservoirs at Stillorgan (of which the two which were first constructed are called the Prince of Wales' Reservoirs) are 4 miles, 5 furlongs, and 150 yards from the city boundary at Eustace Bridge, Leeson Street. The fine new reservoir, called the Gray Reservoir in memory of Sir John Gray, is capable of holding 100,000,000 gallons. The top water-level in the upper of the two original reservoirs is 274 feet, and in the lowest 271 feet above Ordnance datum, or 170 feet above the highest part of the city. The lowest reservoir contains 43,166,548 gallons, with an average depth of 22 feet of water: the middle reservoir contains 43,057,424 gallons, with an average depth of 20 feet of water. The screen-chamber is a handsome octagonal building, of granite ashlar, situated at the south-eastern angle of the lower reservoir. It is 46 feet wide at the bottom, and 49 feet at the level of the floor-line, each side being about 20 feet long on the floor-line. The screens, through which the water is passed to the distributing mains, are of copper-wire gauze, having 30 strands to the square inch. The entire area of the screens is 1,500 superficial feet. Two 27-inch mains, controlled by two 27-inch valves, convey the water from the screen-chamber to Dublin, and a 15-inch main is laid out of it for the supply of Kingstown and Dalkey.

The water is distributed to every part of the city through lines of pipes varying from 27 to 3 inches in diameter, which extend to 110 miles in length. Fountains for the use of the poor have been erected in several parts of the city. Since the Vartry water has been introduced into the city, the necessity for using fire-engines has practically ceased, although such are kept in readiness for any emergency. Hydrants of the pattern known as Bateman and Moore's patent have been put down to the number of 1,390. They are about 100 yards apart. In case of fire a standpipe and

hose is attached to these hydrants, the water thrown from them being sufficient to extinguish the largest fire.

The Dublin Corporation Water Works have been in full working order since 1868. Only in 1893 were there any apprehensions of water famine. The total cost of the works up to the present date has been £733,000—a figure which (with a metropolitan population of 290,837) is equal to about £2 17s. 3d. per head.

From 1861 to 1872 the consumption of water by the city and townships varied from 13 to 16 million gallons per day compared with an estimated consumption of 12 million gallons. From 1872 to 1893 the daily average consumption was about 14 million gallons.

The lowest levels in feet below the sill of the bywash reached in the following years were:—1870, 20·90; 1874, 16·00; 1876, 13·40; 1884, 26·80; 1885, 7·40; 1887, 26·90; 1891, 3·70; 1893, 39·00. In the last-named year the rainfall was only 33·74 inches, and in the late autumn serious apprehensions of a scarcity of water were entertained.

THE COUNTY DUBLIN.

The coast-line of the co. Dublin to the north and south of the capital is dotted here and there with watering-places, celebrated as well for their picturesque and in many instances beautiful situation as for their sea-bathing. In a line from north to south lie Gormanston, some 8 miles south-east of Drogheda, Balbriggan, Skerries, Malahide, Howth, Baldoyle and Sutton, all north of the city. Then to the south we have in succession Merrion, Blackrock, Seapoint, Kingstown, Sandycove, Dalkey, Killiney and Bray. The last-named town is situated for the most part in the co. Wicklow, which here adjoins the co. Dublin, the county boundary at this point being the Dargle river, or Bray Water.

Except at the peninsula of Howth, which attains an elevation of 563 feet, the coast-line north of Dublin is rather flat and tame. South of the city, on the other hand, the coast is bolder, particularly so near the headlands of Dalkey and Bray, where the beautiful ranges of the Dublin and Wicklow mountains terminate

in the picturesque ramparts of the Killiney hills and of Bray Head. The coast-line does not run directly north and south, but curves into a succession of beautiful bays, of which the largest and best-known are Dublin Bay and Killiney Bay.

The Suburbs of Dublin.

The city of Dublin is particularly fortunate in its suburbs. Some of the most attractive of these stud the coast-line of the bay towards north-east in one direction and south-east in the other. The north-eastern maritime suburbs are **Clontarf** and **Dollymount**, which stretch along the northern shore of the harbour of Dublin. These suburbs are now annexed to the city under an Act of Parliament dated 1900. At high-water the views are beautiful, at ebb-tide a large expanse of unsightly mud and sandbanks is laid bare. The population of Clontarf, which is now included in the city of Dublin, was in 1901, 4,669. Facing Dollymount, a far-stretching line of sand-dunes extends northwards towards Sutton on the isthmus connecting the peninsula of Howth with the mainland. The roar of the sea breaking on the beach in front of these sand-dunes gave rise to the Celtic name Clontarf, which signifies the "meadow of the bulls" (Celtic, *Chlain*, a meadow, *tarbh*, a bull, Lat. *Taurus*).

There are splendid golf-links at Dollymount, which are a favourite recreation-ground for residents in Dublin. Beyond Dollymount the northern breakwater of Dublin harbour stretches far into the bay. The southern pier or mole, said to be the longest in Europe, was commenced in 1748 and finished in 1796. It extends from the village of Ringsend, a distance of 17,754 feet to the Poolbeg Lighthouse.

HOWTH.

Howth is a seaport town of considerable size, built on a steep declivity formed by the northern slope of the Hill of Howth. The name brings us back to the time of the Danish invasion and occupation of Ireland, for Howth is the Norse "Hoved," a *head*. The northern shores of Dublin Bay are bounded by the Howth

peninsula, a rocky promontory 2 miles in length and $1\frac{1}{2}$ miles in breadth, and a low sandy isthmus, half-a-mile in width, which unites the peninsula with the mainland. The Hill of Howth, as the bold and far-stretching headland is called, rises to a height of 563 feet above the sea. The town, situated on its northern side, at a distance of 9 miles north-east of Dublin, is thoroughly sheltered. The normal population of the maritime parish and town of Howth was 2,174 according to the census of 1891. The influx of summer visitors largely increases, probably doubles, the population. The sea-front before the town is occupied by the harbour, fifty-two statute acres in extent, which was constructed early in the nineteenth century (1807–1809) at an original cost of £420,472.

The harbour is protected from the open sea by a rocky island called Ireland's Eye (Celtic, *Inis-Ereann*, or *Eria's Isle*), which comprises some fifty-three acres of land and rock, and attains an extreme height of 350 feet above sea-level. This natural break-water is distant about one mile from Howth harbour. Towards the north and east it presents precipitous cliffs. On the west it is less bold, and here and there ferns grow in rare luxuriance.

To the eastward of the town of Howth lies Balscadden Bay, or the "Place of the Herrings," as the name signifies. This is a favourite bathing-place, sheltered from all winds except north-east.

The submarine telegraph-cables between Dublin and Holyhead pass out to sea in this bay. An excellent footpath leads along the cliffs from Balscadden Bay to the Bailey Lighthouse, which stands at the extreme south-eastern point of Howth peninsula. It was built in 1814 to take the place of an older beacon, dating from the time of Charles II., which stood so high upon the hills as to be often lost in mist and fog. The views commanded by the path along the north-eastern face of the Hill of Howth are most beautiful, the air is scented with the perfume of the wild flowers and heather with which the hillside is carpeted, and the sea stretches away to the distant horizon from the very feet as it were of the spectator. In clear weather, the range of the Mourne mountains in the co. Down, Snaefell in the Isle of Man, and Holyhead in Anglesea may occasionally be seen.

The southern side of the Hill of Howth commands magnificent views of the Bay of Dublin, the city and the coast-line to Dalkey,

and the ranges of the Dublin and Wicklow mountains. The hill-side is studded with villa residences. A line of foot-hills with an intervening valley reminds one of the south coast of the Isle of Wight, the breezy downs to the northward affording complete shelter from cold north-west, north, and north-east winds. Amongst the villas is Carrie Breac (the speckled rock), famous as having been the country-house of Dr. William Stokes, *clarum et venerabile nomen*. The south, or Sutton side, of Howth is celebrated for the mildness and salubrity of its climate.

The ancient Celtic name for the Hill of Howth is Ben Edar.

A circular electric railway now carries the visitor to the summit of the Hill of Howth from Sutton, and back to the town of Howth. It is a triumph of engineering skill, and commands exquisite views both of land and sea to north and south.

MALAHIDE.

Malahide, 9 miles north of Dublin, stands on rising ground on the southern side of a shallow estuary, across which the Great Northern Railway is carried on an embankment and a many-spanned tidal bridge. The normal population was 653 in 1891, but it is largely increased during the bathing season. Extensive golf-links run eastward and south-eastward along the sand-dunes which border the "silver strand," or the sandy pebbly beach that stretches past Portmarnock to Baldoyle. The scenery in the neighbourhood of Malahide is tame, but Lambay Island towards the east, and Howth and Ireland's Eye towards the south-east, render the seaward view both picturesque and bold. The high ground south of the town throws off the water after heavy rain, so that the sandy soil dries with great rapidity. As the tide ebbs, large tracts of seaweed-covered shingle and sand become exposed, and in warm weather there is a somewhat overpowering, though presumably a not unwholesome, smell of seaweed. The water supply is derived from wells sunk to a great depth in the hill-side, but this cannot be regarded as satisfactory, as the water thus obtained is extremely hard and the risk of contamination by sewage is great.

Malahide is lighted with gas, and the Grand Hotel is a large and comfortable establishment, with an exceptional *cuisine*.

Malahide Castle, the seat of Lord Talbot de Malahide, is a fine old pile, splendidly situated on an eminence near the town. The demesne is open to the public on presentation of an order, which may be obtained from the Superintendent of the Great Northern Railway, Amiens Street Terminus, Dublin. Adjoining the castle is Malahide Abbey, a noble Gothic structure, with a beautiful eastern window.

At a distance of some 2 miles from Malahide on the high-road to Dublin is the historic town of Swords, where St. Columba founded an abbey as early as the sixth century. The place is full of interest to the archæologist. The ruined palace of the Archbishops of Dublin, dating from the thirteenth century, a massive Norman tower, and a very perfect example of a *cloitheach* (bell-house) or Round Tower should be explored by the visitor. The ancient church and Holy Well of St. Dolough's and the old Round Tower at Lusk are also within easy reach of Malahide.

Dr. Wm. S. Elliott, Admiralty Surgeon and Medical Attendant of the Royal Irish Constabulary at Malahide, reports that "old age is decidedly frequent among the residents," and that the commonest causes of death are circulatory and pulmonary troubles. Renal affections, rheumatism and fever are of infrequent occurrence. There is a system of main drainage, which was laid in the year 1892; it runs through the town and discharges into the estuary. The water supply is derived from wells, the water containing much lime.

SKERRIES.

Skerries stretches for some distance along a rocky promontory about 3 miles south-east of Balbriggan, and 19 miles north-north-east of Dublin. Its population in 1891 was 2,227, inhabiting 545 houses. It enjoys a bracing climate; the soil is dry, and its rocky nature is sufficiently indicated by its name, Skerries being a derivative of the Danish Skjær, a reef, the Swedish equivalent being Skär. In Irish dictionaries the word appears as *Sceir*, a sharp sea rock. Skerries is pleasantly situated, and in clear weather a view is obtained of the whole range of the Mourne mountains in the co. Down, which bounds the northern horizon. It is much resorted to for sea-bathing in the summer months, and

is a quiet, unconventional little watering-place. Several islets lie off the coast, which may be visited in calm weather. On one of these, called Rockabill, stands a first-class lighthouse.

BALBRIGGAN.

Balbriggan lies 22 miles north-by-east of Dublin on the sea-coast. The population in 1891 was 2,443, inhabiting 500 houses. There are salt-works in the town, which is chiefly celebrated for the manufacture of Balbriggan hosiery. Salt-water baths are managed by a limited company. An inner harbour is formed by a pier 420 feet in length. The Great Northern Railway crosses the river Delvia and a portion of the harbour by a noble viaduct of eleven arches, 30 feet span, and 35 feet high. On one side of it a metal flooring, resting on the piers, forms a handsome promenade. Sea-bathing, boating and sailing are the chief amusements.

The climate of both Skerries and Balbriggan may fairly be represented by the meteorological observations made at Ardgillan, the seat of Captain E. R. Taylor, D.L., F.R.Met.Soc. The geographical situation of this Second Order Station is lat. 53° 35' N., long. 6° 10' W., at a distance of 800 yards from the sea. The rain-gauges stand at a level of 210 feet above the sea, the cistern of the Fortin barometer being at a height of 220 feet above sea-level. The equipment of the station is most complete.

Of the seven years, 1892 to 1898 inclusive, the warmest year was 1898 (mean 49°·7), the coldest was 1892 (mean 46°·5). The warmest month was August 1893 (M.T. 60°·6); the coldest, February 1895 (M.T. 33°·5). The hottest day was August 11, 1893 (M.T. 67°·2); the coldest, February 7, 1895 (M.T. 20°·0). The screened thermometer ranged between 77°·0 on August 15, 1893, and 8°·8 on February 7, 1895. The greatest range of temperature in one day was 28°·4 on March 31, 1892; the least was 1°·1 on October 8, 1898. The greatest range of temperature in one month was 40°·4, in February 1895; the least, 22°·0 in November 1895. The greatest annual range of temperature was 63°·9 in 1895; the least 47°·4 in 1898. In 1892 the thermometer fell to or below 32° on 70 occasions; in 1894 on only 19

occasions. Frost occurred in the shade as early as October 11, in 1896, and as late as May 21 in 1894. The thermometer rose above 70° in the shade on 56 occasions in the seven years.

In the six years, 1893–1898, the greatest daily rainfall was 2·45 inches on October 17, 1898. The greatest monthly rainfall was 7·03 inches in July 1896; the least was 0·11 inch in September 1894. The greatest annual rainfall was 32·38 inches in 1895; the least was 22·87 inches in 1892. The yearly number of rainy days varied from 199 in 1897 to 179 in 1894 and 1895.

The mean height of the barometer during the five years, 1894–1898, was 29·949 inches, the annual mean rising to 30·020 inches in 1896, and falling to 29·910 inches in 1895. The highest corrected reading of the barometer was 31·043 inches at 9 a.m. of January 9, 1896; the lowest was 28·517 inches at 9 p.m. of November 10, 1895.

KINGSTOWN.

Sandymount, Merrion, Booterstown, and Williamstown stretch in succession down the southern shores of Dublin Bay to Blackrock, which is a populous suburb (population in 1901, 8,727) and a bathing-place of considerable repute. Contiguous to Blackrock are **Seapoint** and **Monkstown**, with handsome terraces facing the sea and beautifully situated villa residences inland.

Kingstown stands on the southern shore of Dublin Bay, six miles south-east from the capital. The township embraces an area of 905 acres, and the two Registration Districts of Kingstown had, in 1901, a population of 17,360. The town derives its name from King George IV., who embarked here on September 3, 1821, on his return to England after his visit to Ireland. The Royal harbour was commenced in 1816 and finished in 1859 at a cost of £825,000. The east pier is 3,500 feet in length, and the west, 4,950 feet. The pier-heads are 760 feet apart. The harbour embraces an area of 250 acres, the depth of water varying from 15 to 27 feet. The quay along the piers is 40 feet wide, and is protected from the sea by a parapet 9 feet high. The innermost recess of this magnificent harbour in its south-west angle represents the

old harbour of Dunleary, the ancient name of Kingstown. The greater part of the town is built upon granite, but towards the north-west there is a deep alluvial deposit caused by some old river-course; on this, cholera and diarrhoeal diseases were very prone to occur in past years. The granite slopes somewhat steeply and uniformly towards the sea—a circumstance which should be conducive to health. Kingstown enjoys an excellent water supply (derived from the Vartry), and a modern and efficient system of main drainage.

Dr. J. Byrne Power, D.P.H., the Medical Superintendent Officer of Health for the local Urban District Council, has made a careful study of the climate of Kingstown.¹ For this purpose he collated ten years' observations taken at the late telegraphic reporting station at Kingstown of the Meteorological Office, London, similar observations at the Ordnance Survey Office, Phoenix Park, Dublin, as well as observations taken at certain stations on the south and east coasts of England, and published by Dr. J. W. Tripe in the *Quarterly Journal of the Royal Meteorological Society*.

On comparing the temperature of Kingstown with that of the Phoenix Park, Dr. Power found that the mean temperature for each and every month was higher at Kingstown, and that the average of the annual mean temperature for the ten years for Kingstown was 50°·2, while in the Phoenix Park it was 48°·8. This difference is very remarkable when we consider the small distance between the two stations, and demonstrates the great modifying influence of sea temperature upon the climate of places in immediate proximity to the coast.

The mean temperature at Kingstown during the winter months is remarkably high, and a comparison of the average for five years of the mean temperature during the winter months of November, December, January, February, and March, at Kingstown, with that at some English stations, gives the following results, viz.:—Scilly 47°·9, Torquay 46°·9, Penzance 45°·8, Guernsey 45°·0, Barnstaple 44°·6, Kingstown, 44°·4, Ventnor 44°·4, Llandudno 43°·5, Ramsgate 41°·5, and Hastings 41°·2. From this we see, as regards mean temperature during the winter months, that Kingstown occupies a position equal to Ventnor.

¹ *Kingstown as a Health-Resort*, 1898. *Journal of State Medicine*.

As regards range of temperature, the differences between Kingstown and the Phoenix Park are still more remarkable, the mean diurnal range of temperature at Phoenix Park being nearly double that at Kingstown, or to give the eight years' average of the annual mean diurnal range of temperature at each station it is as 16° to 9° .

In this important matter of daily range during the winter months, Kingstown occupies a most favourable position when compared with the favourite winter health resorts in England and the Channel Islands, the following being the averages for the five years of the means for the five winter months at each of the above stations, including Kingstown, viz.:—Scilly 6° , Penzance 6° , Kingstown $7^{\circ}5$, Guernsey $7^{\circ}9$, Ventnor 8° , Hastings $8^{\circ}1$, Torquay $8^{\circ}8$, Llandudno $9^{\circ}5$, Ramsgate $9^{\circ}6$, and Barnstaple $9^{\circ}8$. Therefore Kingstown enjoys an advantage in this point over all the stations in England except Penzance. This fact, as regards its bearing upon the public health, is of great importance, for there is no doubt that great and sudden changes of temperature are very trying to most constitutions.

As showing the absence of extremes of low temperature during the winter months at Kingstown, the following particulars are worthy of note:—During the severe frost of December 1879, the thermometer descended as low as $22^{\circ}6$ at Torquay, 22° at Ventnor, $20^{\circ}9$ at Ramsgate, 19° at Bournemouth and Eastbourne, and $17^{\circ}6$ at Hastings, while at Kingstown and Llandudno it reached only 23° . During the same month the thermometer stood below 32° on twenty-four days at Ramsgate, on twenty-one days at Hastings, on twenty days at Eastbourne, and on nineteen days at Torquay and Bournemouth, while it reached below 32° on only twelve days at Kingstown, on eleven days at Ventnor, and on ten days at Llandudno. The frost of January 1881 was still more severe. During that month the thermometer descended as low as 4° Fahr. in the Phoenix Park, the lowest on record there for 43 years, and at Hurst Castle, near Bournemouth, it reached 15° , while at Kingstown it reached only 17° .

With the object of analyzing the direction of the wind, Dr. Power compiled a table giving the number of days in each month from January 1873 to December 1880, upon which the wind, at a fixed hour each day, blew in a certain direction at Kingstown and

in the Phoenix Park. This table showed a great preponderance of westerly and southerly winds, which is in accordance with the result of all observations in these countries. The easterly winds, proverbially harsh in these islands, fortunately for us are least frequent during the two coldest months of the year—January and December—not attaining their maximum at Kingstown until so late as the month of May, though in the Phoenix Park the maximum is reached in April: in fact during the summer months they are vastly more frequent than during the winter, partaking of the character of a diurnal sea-breeze. Even assuming that the east wind is pernicious, the fact of its prevalence during the early summer months, the portion of the year in other respects most favourable to health, might lead us to anticipate that its effect would be but slightly traceable in the death-rate, and this Dr. Power showed to be the case from a table giving the number of deaths from all causes, and also those from diseases of the respiratory organs and phthisis, for four weeks in each month from January 1873 to December 1880.

The rainfall both at Kingstown and in the Phoenix Park is low, the average for the ten years at Kingstown being 29·5, and in the Phoenix Park 30 inches. It is to be observed that this average includes the rainfall for 1880, which was excessive, amounting to 37·13 inches at Kingstown, and 36·07 in the Phoenix Park. The greatest annual rainfall in Dublin of which Dr. Power can find a record was that of 1846, amounting to 36·11 inches. On comparing the average of the total rainfall at Kingstown during the winter months with that at the above-named English stations, he got the following results:—Penzance 23·5, Guernsey 20·4, Barnstaple 18·4, Torquay 18·3, Scilly 17·1, Hastings 16·0, Llandudno 16·0, Ventnor 15·0, Ramsgate 14·4, and Kingstown 12·7 inches. Thus the rainfall at Kingstown during the winter proves to be considerably less than that at any one of those stations, and amounts to little more than half that at Penzance. This is as might be expected, for the rain-clouds from the Atlantic, borne to Kingstown and to other stations on the east coast of Ireland by the prevailing westerly and southerly winds, are deprived of much of their moisture before they reach us by contact with the high land over which they pass, whereas at stations situated about the south-western extremity of England the rain-clouds are there first tapped

by the land, and discharge a great deal of their rain on the spot.

Notwithstanding its many natural advantages of climate, site, and sanitation, Kingstown presents a relatively high general death-rate, while its birth-rate is also comparatively low. The high mortality is no doubt largely due to the great number of poor people who herd closely together in the by-streets of the town. Nevertheless the zymotic death-rate is low and is decreasing. In the year 1866 Kingstown was visited by an epidemic of cholera, which in about four months carried off 127 lives, or about one-third the average of the annual number of deaths from all causes. This number was at the rate of 77·0 per 10,000 persons living, while during the same epidemic the cholera death-rate was only 33·7 even in Dublin. In 1871 the pure Vartry water was turned on to the township, and from that time to the present Kingstown has been free from any serious epidemic, though frequently exposed to infection from the city of Dublin during the epidemics which have since occurred there.

DALKEY.

Two miles south-east of Kingstown the town and watering-place of **Dalkey** nestle at the foot of the range of picturesque hills which form the southern boundary of the Bay of Dublin. The island from which the town derives its name lies about three furlongs from the mainland, a deep sound intervening. It comprises an area of twenty-two acres. The population of the town was, in 1891, 3,197. Its antiquity is very great, for a charter of incorporation was granted by the enactment 33 Edward III., dated February 8th, 1358, which styles its corporate officers as the "Provost and Bailiffs of the town of Dalkey." Down to the end of the seventeenth century it maintained the character of a port. Dalkey is one of the driest places in Ireland, and when it rains even heavily, the soil dries with amazing rapidity. The district is well planted, so that the glare incidental to many seaside places in bright summer weather may easily be avoided.

From Dalkey a charming drive or walk to Killiney has been made possible by the opening of the Vico road. This thoroughfare skirts the south-eastern slope of the Killiney range of hills at an

elevation of 150 to 100 feet above the sea, and throughout its entire length commands exquisite views of Killiney Bay, Bray and the Wicklow mountains. From this road a well-equipped bathing-place for gentlemen is easily reached by a sloping path along the face of the cliff.

KILLINEY AND BALLYBRACK.

Killiney and **Ballybrack** (population in 1901, 2,862) occupy the south-eastern and southern slopes of the beautiful range of hills which separate Dublin and Killiney Bays. There are three summits, the highest—474 feet above the sea—is surmounted by an obelisk and stands in the centre of Victoria Park, opened by T.R.H. the late Duke of Clarence and the Duke of Cornwall and York in 1887, to commemorate the Queen's Jubilee. From this elevation a magnificent panoramic view may be obtained in fair weather, bounded on the north by the headland of Howth, embracing Dublin and its beautiful bay, the ranges of the Dublin and Wicklow mountains, Killiney Bay, and the open sea to the eastward.

From Sorrento Point, which overhangs Dalkey Sound, as the narrow strait which runs between Dalkey Island and the mainland is called, to Shanganagh river two miles distant, the shores of Killiney Bay are studded with villa residences, towering one over the other up the slopes of the Killiney hills. The climate is one of the driest, if not the very driest, and sunniest in Ireland, and even on a clear winter's morning the sun's rays possess such power as to remind one of May and June. In fact the hills form a rampart against all winds between west and east through north, and entrap the sunshine on their southern face. Such is Killiney. Ballybrack is more of a town in character, and lies about half-a-mile inland. In its vicinity also there are numerous villas and country houses with well-wooded demesnes. The ground falls to the level of a small river which flows through the Vale of Shanganagh into the sea, having been in its upper reaches a mountain bourn. A pleasant walking excursion from Ballybrack is to the well-wooded Bride's Glen, through which the Shanganagh brook descends rapidly as an upland torrent.

A record of the rainfall at Cloneevin, Killiney, has been kept since 1885 by Mr. Robert O'Brien Furlong, M.A.

The yearly average in the 14 years, 1885-1898 inclusive, was one of the lowest in Ireland, namely 26·273 inches. The average annual number of "rainy days" in the same years was 179·2. The following table gives the monthly and yearly averages:—

TABLE OF RAINFALL AND RAINY DAYS, AT CLONEEVIN, KILLINEY.

January	...	...	2·248	...	...	16·8
February	...	...	1·465	...	...	13·2
March	...	...	1·932	...	...	15·7
April	...	...	1·977	...	...	12·7
May	...	...	2·063	...	...	13·1
June	...	...	1·700	...	...	12·5
July	...	...	2·341	...	...	15·2
August	...	...	2·138	...	...	17·1
September	...	...	1·790	...	...	12·2
October	...	...	3·312	...	...	16·0
November	...	...	2·919	...	...	17·1
December	...	...	2·388	...	...	17·3
<hr/>						
14 years.	}	...	26·273	...	...	179·2
1885-1898.						

In 1899 the rainfall at Cloneevin was 31·55 inches on 183 days; in 1900 it was 35·35 inches on 205 days.

Two inland health resorts in the county Dublin are DUNDRUM and LUCAN.

DUNDRUM.

Dundrum is 4 miles south from the General Post Office, Dublin, and about 1 mile distant from the base of the Dublin mountains. The village of the name comprises an area of 35 acres, stands high, and enjoys a salubrious climate. The air is very pure and bracing. The population of the village is 540, but the neighbourhood also is populous, being studded with numerous country seats and villa residences. In former times many consumptive patients were sent for change of air to Dundrum and the adjoining hamlet of Goatstown, where they were dieted on goat's milk. This in addition to the benefit derived from fresh air and sunshine and residence on a quickly drying soil, led to considerable, if not permanent, improvement in many unpromising cases.

LUCAN.

Lucan is an inland town, 8 miles west of Dublin. It stands in the valley of the river Liffey, and comprises an area of 1,126 acres. Its population in 1891 was 1,273. Half-a-mile to the westward of the town there is a well-known sulphur spa, close to which the Lucan Hydropathic Spa Company some years ago erected a commodious modern hotel and sanatorium. The hotel stands on high ground on the south side of the river, so that its climate is not so relaxing as that of the town of Lucan, which lies near the river at this place some 100 feet above sea-level. The spa is a cold hydrogen sulphide water. It enjoyed a widespread reputation at the end of the eighteenth and the beginning of the nineteenth centuries. Two miles further up the Liffey there are weakly mineralized waters at **Leixlip Spa**.

COUNTY OF KILDARE.

The Curragh of Kildare.—This great inland and upland plain or down, over 12 miles square, 6 miles long and 2 wide, is 24 to 30 miles west-south-west of Dublin. It was once a common, but the Crown has converted it into a camp of instruction, and it may well be called the "Aldershot of Ireland." The Curragh (*Cuirreuch*, a race-course) is an undulating grassy plain of immense extent with thickets of whin-bushes (gorse), dense short grass, and a dry sandy subsoil of drift, resting on limestone. Along its highest ridge, which is about 500 feet above sea-level, stretches the largest camp in Ireland. At its western extremity a cavalry barracks of a very substantial kind has lately been erected. Altogether, a force of 10,000 men can be accommodated under more or less permanent cover within the precincts of the camp. The plain is swept by all the winds of heaven, and is cold in winter, but the air is brisk, exhilarating, and pure. The Curragh District Golf Club has been formed by the officers stationed in the camp and at the neighbouring cavalry barracks at Newbridge. The course of eighteen holes covers three miles, most of which is on the level short grass. The hazards are furze-brakes and roads, but the level nature of the "greens" has necessitated artificial bunkers.

KILDARE.

At the western end of the Curragh stands the ancient town of **Kildare** (Celtic, *Cill-Darra*, the church of the oak-tree), population, 1,174. Here, early in the Christian era, lived St. Brigid, in whose honour the old cathedral of Kildare was built. In the graveyard surrounding the cathedral there is a very perfect Round Tower, 103 feet in height. In the south transept is the vault of the Earls of Kildare, descendants of the Geraldines, the most famous of the Norman invaders, and progenitors of the Dukes of Leinster. The Earls of Kildare were often warring against the Kings of England and the representatives of "law and order" in the land. On one occasion an Archbishop of Cashel made complaint to the King that the Earl of Kildare had burned down his cathedral. The Earl was summoned to appear before the Privy Council. When reprimanded by the King, he excused himself by saying that he would not have set the cathedral on fire had he not thought that the Archbishop was inside at the time. This was the same Earl of whom the Parliament complained that "all Ireland could not govern the Earl of Kildare." "Then," said the King, "let the Earl of Kildare govern all Ireland." So he was appointed Lord Deputy, and an excellent Lord Deputy he proved himself to be.

North of Kildare is the chain of the *Red Hills*, extending for some seven miles. The geological formation is the Old Red Sandstone. These hills reach their highest points in the Hill of Allen (676 feet), Dunmurry Hill (769 feet), and the Grange (744 feet), on which last is the *Chair of Kildare*. Geologically the *Chair*, 4 miles distant from the town, consists of a narrow bed of limestone with a protrusion of Lower Silurian shales and grits, together with porphyritic greenstone.

Far to the east and south-east of the Curragh rise the rounded summits of the Dublin and Wicklow mountains, culminating in Lugnaquilla, the summit level of the Province of Leinster, 3,039 feet above sea-level.

The following table showing the meteorological results obtained at Birr or Parsonstown in the King's County, will illustrate the climate of the great Central Plain of Ireland. The table is based on observations taken during the years 1871-1895, both included.

THE CLIMATE OF IRELAND

PARSONSTOWN, KING'S CO.

MONTH.	Barometer.	Dry Bulb.	Wet Bulb.	Mean Max. Temp.	Mean Min. Temp.	Mean Temp.	Absolute Max. Temp.	Absolute Min. Temp.	Hrs. of Bright Sunshine.	of Possible Sunshine.	Rainfall Average.
									Hrs.	/.	Ins.
January	29.895	38.3	37.3	45.0	33.6	39.3	57	6	50.8	21	2.99
February	29.915	39.1	37.8	46.8	35.1	41.0	59	6	68.0	25	2.16
March	29.925	40.1	38.6	49.9	34.9	42.4	66	18	114.7	32	2.20
April	29.883	45.1	42.7	54.9	38.2	46.6	73	21	155.8	38	2.04
May	29.963	51.0	47.9	59.7	42.8	51.3	77	28	180.2	37	2.31
June	29.981	56.2	52.9	64.9	48.5	56.7	85	32	173.7	35	2.34
July	29.914	57.9	54.8	66.2	51.4	58.8	89	37	136.5	27	2.98
August	29.908	57.2	55.1	65.7	51.5	58.6	82	35	131.0	29	3.67
September	29.948	52.8	50.9	61.7	47.2	54.5	79	30	124.7	33	2.92
October	29.887	45.5	43.9	54.6	40.4	47.5	68	22	97.1	30	3.12
November	29.852	41.8	40.3	49.1	37.0	43.1	62	30	63.1	25	2.86
December	29.891	38.3	37.0	45.1	33.5	39.3	58	8	45.0	20	3.09
Means and Totals.	29.913	46.9	44.9	55.8	41.9	48.8	80 in 1876	6.71 1881	1,406	36	2.98

COUNTY WICKLOW.

BRAY.

Bray, co. Wicklow, is one of the largest and most favourite watering-places in Ireland. Its normal population in 1901 was 7,284, but in the summer season it probably exceeds 10,000. It is situated near the mouth of Bray river, some 12 miles south-east of Dublin, with which city it is in constant communication by two lines of railway under, however, the same management—that of the Dublin, Wicklow and Wexford Railway Company. The sea-front extends for more than a mile from the harbour at the river's mouth to the bold promontory of Bray Head, which attains an extreme elevation of 793 feet in its southern ridge. Originally the sea-front consisted of a number of sand-dunes, but nearly half a century ago these were levelled, and an esplanade was formed. This is now lined by a substantial fenced sea-wall, along which a broad concreted marine promenade is carried almost the entire length of the esplanade. The whole is lighted with electricity, and proves one of the great attractions of Bray at all seasons of the year. Apart from the business part of the town, there are numerous private roads and avenues, especially in the district called Novara, the architecture of the houses and villas being in many instances highly ornamental.

As a rule, the house drainage has been carefully looked after. But the main drainage system still leaves much to be desired,

and there can be no justification for discharging even a part of the sewerage of this populous place into the harbour at the river's mouth. The town and its suburbs (for such do exist) are supplied with Vartry water from the Corporation of Dublin Water Works. Ample facilities exist for bathing in the open sea, and there are also hot and cold salt-water baths.

Bray is surrounded by exquisite scenery—mountain, woodland, valley, and sea, and the entire countryside is occupied by private demesnes, access to which is generously granted by their lordly and wealthy owners.

RAINFALL AT FASSAROE, BRAY, CO. WICKLOW, DURING EACH QUARTER OF THE FORTY-SIX YEARS, 1853-1898.

YEARS.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	Whole Year.	YEARS.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	Whole Year.
1853	8.49	8.30	7.26	10.16	34.21	1875	5.59	14.64	8.23	8.31	36.77
1854	8.20	6.27	3.73	9.06	27.26	1876	12.61	12.94	10.97	5.56	42.08
1855	3.94	5.09	6.75	10.23	26.01	1880	10.32	6.66	10.96	16.72	44.66
1856	8.98	10.45	10.45	9.00	38.88	Average					
1857	7.44	11.94	5.32	7.05	31.75	10 Years,	9.80	7.72	9.57	12.71	39.80
1858	6.88	13.71	9.33	10.76	40.68	1871-80					
1859	9.15	9.07	9.14	12.20	39.56						
1860	14.87	13.96	11.47	16.73	57.03						
Average											
8 Years,	8.49	9.85	7.96	10.65	36.92						
1853-60											
1861	20.33	5.33	14.26	11.04	50.96	1881	11.82	8.48	9.47	14.77	44.54
1862	14.13	10.26	8.77	12.63	45.79	1882	9.84	11.11	10.79	17.04	48.78
1863	9.80	4.14	6.84	14.93	35.71	1883	18.59	10.39	13.14	9.26	51.38
1864	8.43	3.47	3.79	15.96	31.65	1884	18.97	5.50	5.35	6.98	36.80
1865	10.15	7.46	8.97	15.63	42.21	1885	13.33	10.39	9.48	9.97	43.17
1866	12.50	9.67	7.63	8.41	38.21	1886	11.95	11.27	6.90	19.07	49.19
1867	14.05	8.62	6.42	6.18	35.27	1887	7.57	3.57	7.50	10.73	29.37
1868	9.12	5.47	12.53	14.59	41.71	1888	10.27	9.18	8.27	16.61	44.33
1869	12.41	11.22	6.24	9.09	38.96	1889	9.89	8.10	9.97	12.58	40.54
1870	10.71	3.40	5.29	13.73	33.13	1890	11.75	8.37	8.43	11.48	40.03
Average						Average					
10 Years,	12.16	6.91	8.07	12.22	39.36	10 Years,	12.40	8.63	8.93	12.85	42.81
1861-70						1881-90					
1871	9.49	6.87	9.81	7.08	32.25	1891	3.96	11.08	9.75	20.82	45.61
1872	12.82	8.98	8.31	20.39	50.50	1892	7.54	9.94	10.69	10.31	38.48
1873	8.96	2.41	9.77	6.60	27.74	1893	9.11	3.66	5.85	7.64	26.26
1874	7.46	4.17	7.97	11.88	31.48	1894	9.50	11.54	9.02	14.06	44.12
1875	9.84	5.18	10.11	16.25	41.38	1895	11.79	4.21	9.00	15.23	40.23
1876	8.61	4.55	9.04	23.40	45.60	1896	5.38	2.74	15.19	14.41	37.72
1877	12.30	10.80	10.50	10.90	44.50	1897	11.39	9.64	10.72	12.26	45.01
						1898	6.73	11.62	6.26	13.23	37.89
						1899	11.32	9.46	10.60	11.05	42.43
						1900	11.79	7.59	12.02	13.83	45.23
						Average					
						10 Years,	8.85	8.15	9.91	13.29	40.20
						1891-1900					

The place is ancient and possesses considerable historic interest. In 1173 the manor of Bree, which evidently received its name from Bray Head (the Celtic word *Bri* signifying a hill or rising ground, the same as the Scotch word *Brae*), was granted by the Earl of Pembroke, then Lord Deputy of Ireland, to Walter de

Riddlesford, one of the early Norman adventurers. In 1215 the Abbot of the Monastery of St. Thomas, near Dublin, obtained it at a rent of three, and a fine of sixty, marks. In these as well as in subsequent times, it was frequently assailed by the mountain septs of the O'Byrnes and O'Tooles. In 1316 they destroyed the castle, but were defeated on the same day by an English force under Edmund de Boteler. In 1402 it was the scene of a great battle between the before-named septs and the citizens of Dublin, headed by John Drake, their Provost. At the dissolution of religious houses the Manor, among other lands of the Abbey of St. Thomas, was granted to Sir Thomas Brabazon, an ancestor of the Earl of Meath, who enjoys in fee at the present time part of the town.

ENNISKERRY.

Enniskerry (population, 256) may well claim to be looked on as an inland health resort. It occupies the steep southern slope of the valley or ravine through which the Glencullen river runs to join the Dargle river, and so to form the "Bray Water," as Bray river used to be called in Sir William Petty's time. The neat village, which derives its name from the physical character of the bed of the neighbouring river (the ford of the "scairbih," or "rough river-crossing"), is distant three miles inland from Bray towards the west. It is singularly picturesque, and is surrounded by scenery of the most varied and romantic description. The lordly demesne of Powerscourt adjoins the village, and within its 1,400 acres are, as it were focussed, the beauties of the co. Wicklow. Enniskerry is noted for the purity of its atmosphere. Owing to its valley site, it is sometimes warm and relaxing in summer, but on the other hand it is sheltered in winter. Two miles further inland, at the foot of the lofty range of mountains, which extends from Djouce (2,384 feet) on the south to Kippure (2,473 feet) on the north, lies a district, studded with foothills, which from the extreme purity of the air and the bracing climate, works wonders in cases of unresolved pneumonia, early pulmonary consumption, and bronchial catarrh as well as asthma. It is to be remembered that the sea is only some five miles distant, so that there is a remarkable "blend" of mountain and sea air throughout this lovely district.

Owing to the proximity of the Wicklow and Dublin highlands, the rainfall is heavy. But the soil dries quickly, and there is little or no marshy land. A meteorological station has existed for many years at Fassaroe, the residence of Mr. Richard M. Barrington, LL.D., M.A., Barrister-at-law. To this gentleman I am indebted for the following Meteorological Tables.

Table I. shows the average annual readings of maximum, minimum, grass minimum, wet and dry bulb thermometers at Fassaroe, near Bray, co. Wicklow, for thirty-seven years (since 1864); also the annual rainfall and number of rainy days, and the date on which the harvest commenced each year during the same period. A short supplemental table is added, showing the rainfall from 1853 to 1864, and the date of reaping from 1837 to 1863.

From 1864 to 1896 the maximum, minimum, wet-bulb and dry-bulb thermometers were placed in a screen which did not completely shade the instruments. In 1896 a Stevenson's screen was erected alongside the old one, and a new set of thermometers obtained, and for that year the readings of both sets of instruments are given for the sake of comparison. The data for 1897 and onwards are from Stevenson's screen.

It will be seen that the records of the maximum previous to 1896 are about two degrees too high, of the minimum $\frac{3}{4}$ degree too low, of the dry bulb $\frac{1}{2}$ degree too high, and the wet bulb is as might be expected practically the same in both screens, being least influenced by radiation. The position of the grass minimum was unaltered throughout.

The hour of observation is 9 a.m. to 9.15 a.m. In April 1878 the rain-gauge was moved 50 yards to south-west owing to growth of trees, or rather a new one was erected at this distance. Experiments continued for one year proved that this instrument registered .093 per cent. (or slightly less than one-tenth) more than the old gauge which was left undisturbed, therefore to be strictly comparable the record of the annual rainfall previous to 1878 must be increased by nearly one-tenth.

During the period under review the warmest year was 1868, and the hottest month July 1868.

The coldest year was the ever-memorable and disastrous 1879, and the coldest month was February 1895, when Powerscourt waterfall was almost frozen up.

THE CLIMATE OF IRELAND

TABLE I.

Year	Maximum.	Minimum.	Minimum on grass.	Wet bulb.	Dry bulb.	Rain in inches.	Rainy days.	Harvest began.
1864	...	...	...	47.73	50.65	31.29	157	August 5
1865	...	43.58	...	49.16	52.22	42.37	179	" 11
1866	...	42.38	...	47.97	51.03	38.15	204	" 9
1867	...	42.46	...	47.85	50.79	36.17	184	" 21
1868	60.44	44.00	39.34	49.77	52.92	41.71	162	July 23
1869	58.28	43.73	39.49	48.83	51.35	39.06	168	August 10
1870	58.29	42.06	38.88	47.91	51.03	33.20	138	" 2
1871	56.76	42.82	39.64	47.91	50.99	33.25	174	" 16
1872	57.67	42.23	41.17	47.97	50.61	50.50	234	" 19
1873	57.07	42.09	40.63	47.63	50.50	27.74	185	" 8
1874	58.17	42.27	40.38	48.16	51.40	31.48	181	" 1
1875	57.05	42.63	40.37	48.48	51.04	41.38	204	" 16
1876	57.07	42.64	39.22	47.87	50.80	45.60	186	" 8
1877	56.89	42.45	38.47	47.28	49.95	44.50	210	" 28
1878	57.44	42.69	39.97	48.17	50.57	37.24	197	" 12
1879	54.55	40.11	38.41	45.45	47.94	42.08	201	Sept. 1
1880	57.69	42.34	37.67	47.88	50.69	44.66	188	August 13
1881	56.32	41.55	37.81	46.83	49.53	44.54	206	" 18
1882	57.40	42.37	38.79	48.00	50.72	48.78	244	" 17
1883	56.74	40.67	38.14	46.94	49.85	51.38	216	" 27
1884	58.15	42.85	38.88	48.35	51.46	36.81	190	" 13
1885	56.19	41.36	36.49	46.82	49.80	43.17	202	" 25
1886	56.18	41.88	37.43	46.80	49.81	49.19	210	" 23
1887	57.42	41.91	37.38	46.99	50.49	29.37	156	July 25
1888	56.36	41.73	35.50	47.53	49.91	44.34	192	August 27
1889	57.54	42.73	38.46	47.75	50.78	40.54	178	" 16
1890	57.66	41.68	37.96	47.61	50.80	40.04	207	" 13
1891	57.18	42.18	40.12	47.22	50.31	45.62	212	" 17
1892	55.88	41.02	38.55	46.13	49.13	38.49	190	" 22
1893	59.64	43.45	40.65	48.70	52.46	26.25	169	July 24
1894	57.40	42.10	40.04	47.69	50.65	44.11	199	August 17
1895	56.83	41.17	38.53	46.80	49.78	40.20	182	" 14
1896	58.27	42.70	39.32	47.75	50.99	37.71	163	July 23
	56.34 *	43.42		47.69	50.50			
1897	55.61	43.60	40.68	47.65	50.31	44.01	205	August 14
1898	57.24	44.97	41.41	48.72	51.19	37.89	180	" 19
1899	56.75	44.45	40.91	48.43	51.23	42.43	185	" 10
1900	55.19	43.76	39.81	47.37	50.11	45.23	210	" 17

TABLE 1A.

Year.	Rainfall in Inches.	Year.	Rainfall in Inches.
1853	34.21	1859	39.56
1854	27.26	1860	57.03
1855	26.01	1861	50.96
1856	38.88	1862	45.77
1857	31.75	1863	45.71
1858	40.68	1864	31.29

* Stevenson screen.

TABLE I_B.

SHOWING DATE HARVEST BEGAN AT FASSAROE 1837-1863.

1837	August 25th	1846	August 11th	1855	August 13th
1838	" 23rd	1847	" 13th	1856	" 12th
1839	Sept. 2nd	1848	" 10th	1857	" 6th
1840	August 23rd	1849	" 14th	1858	" 11th
1841	" 19th	1850	" 13th	1859	" 1st
1842	" 13th	1851	" 16th	1860	" 29th
1843	" 25th	1852	" 12th	1861	" 8th
1844	" 10th	1853	" 24th	1862	" 26th
1845	" 28th	1854	" 21st	1863	" 10th

TABLE II.

SHOWING SINCE 1853 THE WETTEST AND THE DRIEST MONTHS, AND SINCE 1864 THE COLDEST AND THE HOTTEST MONTHS.

		Wettest.		Driest.		Coldest.		Hottest.
January	1860	10·27	1896	·75	1884	34·34	1875	45·68
February	1861	10·42	1891	·18	1895	33·86	1869	47·20
March	1867	6·58	1893	·26	1892	38·92	1893	48·55
April	1859	9·51	1864	·46	1879	44·95	1893	53·20
May	1878	7·63	1861	·17	1869	49·16	1896	58·18
June	1860	9·73	1887	·28	1879	56·95	1887	65·41
July	1896	6·18	1864	·41	1879	57·31	1868	67·03
August	1868	6·55	1884	·65	1896	58·42	1880	63·98
September	1896	7·90	1865	·09	1877	54·47	1865	65·90
October	1866	9·25	1889	1·07	1896	44·60	1890	53·13
November	1888	8·29	1867	·63	1878	39·55	1881	50·08
December	1876	9·85	1873	·55	1878	35·29	1868	45·58

The driest year, allowing for corrections, was 1893, when only 26·25 inches were registered. The driest month, and probably the most remarkable in every way, was September 1865, when only ·09 of an inch of rain fell. It was the warmest month of that year.

The wettest year was 1860, when 57·03 inches were registered. The wettest month was February 1861, when 10·42 inches of rain fell.

Taking the coldest months, it is remarkable that the temperature of August did not fall as low as July, though June, July and September have exceeded August in warmth.

The earliest harvests at Fassaroe since 1837 were 1868 and 1896, both of which began on July 23rd. The latest harvests were 1839 and 1879, commencing on September 2nd and 1st respectively.

There were only four July harvests in 61 years, and two September harvests, the average date of reaping being August 15th.

GREYSTONES.

Greystones (permanent population in 1891, 516), situated on a rocky promontory some 2 miles south of Bray Head, and at a distance of 17 miles by rail from Dublin, is one of the most popular watering-places in Ireland. Its situation is in all respects admirable. Sheltered on the north-west by the bold headland of Bray Head, and the high lands connecting it with Little Sugar Loaf (1,190 feet), it is also protected on the west and south-west from the rain-bearing winds by successive ranges of hills, culminating in the Wicklow mountains, which attain their summit level (3,039 feet) in Lugnaquilla. From north through east to south-east Greystones is freely exposed to the sea winds, which blow much more frequently than might be supposed in summer, particularly as sea-breezes during the warmer portion of the day. It is true that rain falls heavily at Greystones in cyclonic south winds, but the rocky nature of the soil causes all trace of damp to disappear within a few hours after the heaviest downpour. Hence the climate of Greystones may be described as dry and bracing. The amount of sunshine is considerable, for the mountains intercept the clouds just as they do rain so long as winds from westerly points prevail. Excellent sea-bathing, boating and fishing, golf-links, an endless variety of beautiful walks and drives into the hills and valleys of the co. Wicklow, famed for its romantic scenery, and the good hotel and lodging accommodation which await the visitor, render Greystones an attractive residence whether in summer or in winter. Indeed, in the latter season it often happens that to go from Dublin to Greystones is like passing from winter into summer. The water supply and drainage system are not satisfactory. Vartry water has been introduced into the houses and villas, which have been recently built on the Burnaby estate south of Greystones, but the place in general depends for its water supply on a mountain stream which flows from the slopes of Little Sugar Loaf and Kendlestown Hill into a reservoir situated far too near a public road to be above suspicion of contamination. The arrangements for filtering the water are defective, and complaints are sometimes heard of want of pressure in the higher parts of Greystones. As the supply is derived from

deep mountain springs it is constant even in dry weather, but the permanent hardness of the water is considerable.

Rainfall observations have been taken for several years at Greystones. The following table (p. 426) has been compiled at my request by Mr. Robert Cathcart Dobbs, J.P., C.E., of Knockdolian, Greystones. It gives the monthly rainfall and rainy days for each of the eleven years, 1888–1898. The record for the month of March 1890 is wanting, but the average rainfall and number of rainy days for March in the remaining ten years of the series have been interpolated. The table shows that the average annual rainfall is 33·814 inches, distributed over 171 days. The rainiest months are December, November, August and October, whilst the months of heaviest rainfall are November, October, August and December. June has the largest number of fine days—19; while September and February come next. February is the month in which least rain falls, but allowing for the small number of days (28) in that month, March takes its place.

In 1899 the rainfall at Greystones was 36·69 inches on 182 days; in 1900 it was 42·72 inches on 194 days.

DELGANY.

Delgany—of which the normal population in 1891 was only 192—is charmingly situated about 2 miles inland from Greystones, and enjoys a mild and equable climate. The pretty village stands on high ground along the northern slope of a deep valley, which may be looked on as a continuation at right angles and to the north-east of the Glen of the Downs—a wooded ravine a mile and a half long, and far-famed for its beauty, and very closely resembling the Pass of Killiecrankie in Perthshire.

The air at Delgany is delightful—a blend of mountain, sea and country air. Owing to the steepness of the hill-side on which the village is built, there is no lodgment of water, and the surface dries quickly after the heaviest and most protracted rains. Even in winter the sun has considerable power, and lofty forest trees afford shelter from high winds from all points of the compass.

Many years ago the late Dr. Barter, of St. Ann's, Blarney, co. Cork, established a Hydropathic Institution at Delgany, and many invalids were attracted to it. After several years this establish-

ment was closed, and up to the time of writing it has not been re-opened. There can be no doubt, however, that Delgany is admirably adapted for either a winter or a summer residence for an invalid seeking for rest, fresh air, and beautiful scenery. The water supply is drawn from the Vartry mains, which pass through the glen at a distance of half-a-mile from the village. The neighbouring demesne of Bellevue, the seat of the La Touche family, commands exquisite views of the Sugar Loaf mountains, the Glen of the Downs, the sea, and the coast-line from Bray Head on the north to Wicklow Head on the south.

Altadore Sanatorium is delightfully situated among the foothills of the Wicklow mountains some 3 miles inland from Delgany. It was opened about a year ago for the treatment of diseases of the lungs on the Nordrach system, and is in charge of a physician, Dr. J. C. Smyth, who acquired his knowledge of the treatment at Nordrach under Dr. Otto Walther. The house stands in its own grounds of 480 acres, at a height of 750 feet above sea-level. It is well protected on the north by the Downs Hill (1,232 feet), while to the east and south-east it commands a fine view of the sea, some 5 miles distant. It thus combines the advantages of pure mountain and sea air. The subsoil is gravel, and the walks consequently dry quickly after rain. The rainfall is moderate, about 35 inches annually. The neighbourhood abounds in spots of beauty and interest.

WICKLOW.

Wicklow (population, 3,288 in 1901), picturesquely situated on the northern slope of Wicklow Head and stretching along the shore of a beautiful bay for some distance, enjoys a twofold distinction, as the county town and as a favourite summer resort and watering-place. For a mile and a half to the north of the town the river Vartry, whence the water supply of Dublin is derived, forms a series of lagoons on the landward side of a raised sea-beach. This fine stretch of grassy sward is called the Murrow of Wicklow. It is covered with wild flowers and is swept by alternate mountain and sea breezes, according as the wind is westerly or easterly. The Irish word *Murbhach* (Murvagh) means a flat piece of land extending along the sea; a salt marsh (Joyce). The etymology is *muir*,

the sea, and *nugh*, a plain, and the Murrow of Wicklow may well be described as a "sea-plain." There are excellent facilities for sea-bathing at Wicklow, which with the adjoining promontory reminds one of Llandudno and Great Orme's Head. The harbour is protected by a breakwater. The neighbourhood is famed for the beauty of its scenery, and may be explored by rail or road.

Wicklow is a very ancient town. Its Irish name is Kilmantan, or the Church of St. Mantan, who lived in the time of St. Patrick. In old documents the place is called Wikinglo, Wygyngelo and Wykinlo, in which names we recognize traces of a Danish occupation.

The climate of Wicklow is bracing, the town being open to westerly and northerly winds, but sheltered from those blowing from the south-east and south, by Wicklow Head, which attains an altitude of 614 feet due south of the town. The water supply is derived from a reservoir at the height of some 400 feet on the hill-side, a mile west-south-west of the town.

THE NATIONAL HOSPITAL FOR CONSUMPTION.

At a distance of seven miles north-north-west of Wicklow stands the **National Hospital for Consumption for Ireland**. It was opened for the reception of twenty-four patients by the Marchioness of Zetland on March 19. 1896. The hospital is most favourably situated on the southern slope of a grassy upland, midway between a mountain range towards the west and the sea towards the east. At the hospital there is a fully-equipped meteorological station of the "Second Order." The following table contains an abstract of the observations taken during the year 1898 by the resident Medical Officer and Registrar, Dr. B. H. Steede, M.D., Ex.-Sch., University Student and Medical Travelling Prizeman, University of Dublin. The results fairly represent the climatic conditions of the Wicklow district.

The building is situated 3 miles from the sea on the southern slope of a hill. To the south-west and west, but at a distance of a mile or two, lies a chain of hills 700 or 800 feet high. The exact height of the site of the hospital itself above sea-level is 270 feet.

The hill on which the hospital is situated shelters it from the north, and also, although to a less extent, from the east, while

ABSTRACT OF METEOROLOGICAL OBSERVATIONS TAKEN AT THE NATIONAL HOSPITAL FOR CONSUMPTION
DURING THE YEAR 1898.

MONTH.	TEMPERATURE.				RAIN.						PREVALENT WINDS		
	Abs. Max. Temp.	Date.	Abs. Min. Temp.	Date.	Mean Daily Max. Temp.	Mean Daily Min. Temp.	Rain-fall.	Wet Days in which more than .005 inch fell.	Max. Fall in 24 Hours.	Date.		Mean Daily Tension.	Mean Daily Humidity.
January	58.8	30th	31.0	10th	50.2	43.0	2.316	9	1.001	2nd	.276	84	S.W.; W.
February	57.0	1st	27.0	21st	47.4	36.8	1.607	18	.332	25th	.231	80	W.
March	59.0	18th	31.2	9th	47.0	36.6	.844	13	.148	6th	.207	76	W.; N.E.; N.W.
April	61.0	7th	32.8	5th	52.8	41.0	4.441	15	1.270	30th	.271	82	W.; S.W.
May	64.0	8th	35.2	16th	55.5	43.4	3.251	19	1.119	2nd	.204	81	N.W.; W.
June	73.0	17th	41.0	2nd & 3rd	60.3	46.9	2.459	14	1.230	5th	.358	78	S.W.; N.W.
July	76.0	30th	42.8	4th	66.6	51.8	1.380	6	.480	21st	.397	79	N.W.; W.
August	75.0	2nd	48.1	29th	66.3	52.0	3.803	16	.716	25th	.395	80	W.; N.W.
September	73.0	3rd	41.7	29th	65.3	51.0	1.991	12	.538	27th	.422	85	W.; S.E.
October	67.0	4th	37.7	20th	57.7	47.0	4.385	17	.820	15th	.340	85	S.E.; W.
November	62.2	16th	31.0	29th	53.0	40.8	4.721	18	1.652	23rd	.276	84	S.W.; W.
December	58.0	17th	31.9	30th	50.9	43.0	1.940	17	.611	26th	.272	84	S.W.; W.
Extremes, Totals and Means.	76.0	30th July	27.0	21st Feb.	56.1	44.4	3.218	174	1.652	23rd Nov.	.311	81	

from the southerly aspect both of the site and of the building the full benefit is derived of all possible exposure to the sun.

The soil consists largely of gravel and is therefore very porous, and lends itself readily to a system of drainage. In its deeper parts there are very abundant springs, the water from which finds its way freely through the marly soil, without at any time rising to the surface. This peculiarity of the soil has been taken advantage of in providing a drainage system which has proved very satisfactory. The sewerage from the house is conducted through a closed concrete drain to a closed cesspool, where the solid matters collect, and from which they can be removed when this may become necessary. The overflow from this cesspool, which is entirely liquid, is never allowed to come to the surface of the ground. It is led off by a branching underground drain through the gravel soil, through which it freely percolates in all directions. As the whole system is practically closed no effluvia can arise, and as the natural filter in which the refuse water in this way disappears is four or five feet below the surface, it is impossible that the ground should be contaminated.

Treatment of patients is conducted on the usual lines, in which open air and a superabundance of nourishment have the chief place, with also moderate exercise, attentions to the functions of the skin, and sufficient rest in bed.

ARKLOW.

Arklow (lat. 52° 45' N.; long. 6° 8' W. Population, 4,172 in 1891) stands on the side of a hill overlooking the sea on the south bank of the Arklow river, as the Ovoca river is sometimes called in this part of its course. It may be of interest to mention that this river flows through the loveliest scenery in the county Wicklow. Rising close to the source of the river Liffey near Sally Gap in the Wicklow mountains, 1,778 feet above the sea, it flows as the Annamoe river through Lough Tay and Lough Dan past Avonmore to Laragh, near the celebrated Seven Churches of Glendalough. Receiving the waters of the Vale of Glendalough and those of the Vale of Glendasan, it becomes the Avonmore river, and under this name flows through the Vale of Clara to Rathdrum, where it enters the far-famed Vale of Ovoca. Here it is presently joined

by the Avonbeg coming from Glenmalure, at a spot which the poet Thomas Moore has immortalized in his lines:—

“There is not in this wide world a valley so sweet
As the Vale in whose bosom the bright waters meet;
Oh! the last rays of feeling and life must depart,
Ere the bloom of that valley shall fade from my heart.”

The united streams flow on as the Ovoca river, until at Wooden Bridge a second meeting of the waters takes place at the confluence of the Aughrim river with the Ovoca. The augmented stream then flows south-eastwards to the sea at Arklow, a distance of five miles, its lofty banks being covered with luxuriant woods on each side—those of Shelton Abbey, the seat of the Earl of Wicklow on the north: those of Glenart, the seat of the Earl of Carysfort, on the south. A bridge of nineteen arches spans the river at the town of Arklow.

In the Vale of Ovoca there are several copper mines—copper pyrites being found on both sides of the river, associated with beds of iron bisulphuret. On a mountain called Croghan-Kinsella, south of the Vale of Ovoca, gold mines were worked at the end of the eighteenth and beginning of the nineteenth century. The Wooden Bridge Hotel is well adapted as a halting-place for an invalid, situated as it is in a sheltered mild valley.

Arklow is a place of great antiquity. It was mentioned as *Arclough* in legal documents of the reign of Henry II. It is a busy town, with important fisheries and a brisk shipping trade. North of the mouth of the river stretches a long line of sand-hills, among which Messrs. Kynoch and Co. have of late years developed a prosperous cordite manufactory, occupying a space of some 200 acres. The bathing facilities are not of a first-class order, but the beauty of the surrounding scenery and the splendid air make Arklow an attractive health resort. The fishermen and their families form a separate community from the townsfolk, and live in a village consisting of thatched white cottages, known locally as “The Fisheries.”

CO. WEXFORD.

COURTOWN HARBOUR.

Courtown Harbour (population, 269), a small, neat, and very

healthy seaside health resort and bathing-place in the Co. Wexford, is situated $3\frac{1}{2}$ miles south-east of Gorey (population, 2213), a station on the Dublin, Wicklow and Wexford Railway. The pleasant little watering-place stands at the mouth of the Owenavorragh river, which, unlike all other streams in the south-east of Ireland, has a northerly course from its source to within a mile or so of its entrance into the sea through Courtown Harbour. To the southward runs a line of cliffs of moderate height for 6 miles as far as Cahore Point, the coast-line extending from north-north-west to south-south-east. South of the Cahore the shore trends away to the south-west until Wexford Harbour is reached at a further distance of 16 miles. In front of the cliffs is a sandy beach, suitable for bathing purposes, and forming an unlimited sea-walk. To the northward a line of sand-dunes stretches as far as the eye can reach. For some distance from Courtown the sand-hills are covered with a luxuriant grove of buckthorn bushes (*Rhamnus catharticus*). It is said to have sprung up naturally from a single shrub planted in the sandy soil a few years ago. Four miles due north Tara Hill rises to a height of 828 feet, affording opportunity for a good climb. This hill, as seen from Courtown, bears a singular resemblance to Bray Head, of which it is a striking and exact replica both in height and outline as well as regards situation.

Among the attractions of Courtown must be reckoned the wooded glades of the demesne of Courtown House, the residence of the Earl of Courtown. The evergreens, tree-like in size and growing wild in the park, testify to the mildness of the climate. The rainfall at Courtown House was 33·23 inches on 158 days in 1899, and 40·85 inches on 177 days in 1900.

The other seaside resorts in the co. Wexford are Rosslare and Kilmore. Still smaller places are Blackwater and Curracloe, on the shore north-east of Wexford, between Cahore Point and the Raven, as the northern point of Wexford Haven is called. **Curracloe** is not regarded by the Wexford people of much value as a health resort. The air is not so pure and bracing as at Kilmore on the south coast, probably owing to the adjacent large areas of reclaimed lands. The lodging accommodation also is indifferent, the cottages being very small, and many of them damp. The population of **Blackwater** was 196 in 1891. It is situated some

six miles further up the coast than Curracloe, at some distance from the sea. There is a small harbour at the mouth of a stream which gives its name to the village.

WEXFORD.

Wexford (Danish, *Weisford*) is built on sharply rising ground along the south-western shore of the estuary of the river Slaney, where it empties itself into the Wexford Haven or Harbour. Called Menapia by Ptolemy, and afterwards Carmen in the *Annals of the Four Masters*, the place was occupied by the Danes in the ninth century. They renamed it Weisford, and held it until 1169, when it surrendered to the allied forces of King Dermot McMurrough and the Anglo-Norman invaders under Robert Fitz-Stephen and Fitz-Gerald. The town has passed through many vicissitudes, and figures prominently in the history of Strongbow (Richard de Clare, Earl of Pembroke), of Cromwell, and of the Irish Rebellion of 1798.

Wexford stands in lat. 52° 19' N.; long. 6° 28' W. It is an ancient, quaint, but well-to-do town of 11,154 inhabitants (in 1901). The streets are narrow, tortuous, and hilly, but the fine quay is a redeeming feature, extending for two-thirds of a mile along the sea-front. Remains of the old town walls still exist, as well as five of the towers, three square and two round. The West Gate Tower, on high ground, affords a fine view of the estuary and harbour. Close by stand the picturesque ruins of the Priory of SS. Peter and Paul, which was founded towards the close of the twelfth century. The priory is commonly called Selsker Abbey.

At Ferry Carrig Castle, two miles from Wexford, the river Slaney is crossed by a fine bridge, from which beautiful views are obtained both up and down stream.

The climate of Wexford is mild but moist. In 1899 the rainfall was 35·47 inches on 166 days; in 1900 it was 42·54 inches on 176 days.

ROSSLARE.

Rosslare is the name given to a scattered hamlet about 7 miles south-east of Wexford. It is built upon a remarkable sea-

beach 8 miles in length, which stretches from Rosslare Harbour in the east to Rosslare Point in the north. The 6 miles from Rosslare proper to the Point, at the mouth of Wexford Harbour, consist of a gradually narrowing spit of sand-hills, which have been thrown up in front of the harbour, effectually sheltering it from the open sea to the eastward. On the landward side of these sand-dunes a large area of land has been reclaimed and is protected by a substantial dyke. The beach in front of the sand-hills shelves very gradually and is therefore safe for timid bathers. It consists of fine, firm sand, and makes an excellent promenade and bicycle track. The air is bracing and pure, and the whole place reminds one of Scheveningen near the Hague in Holland. Owing to the sandy soil, the ground dries quickly after even heavy rain. Two miles to the eastward is the new harbour with its breakwater and pier. These works, rendered necessary in consequence of the shallowness of Wexford Harbour, are not only developing the commerce of the south-east of Ireland, but will ultimately facilitate traffic with England and Wales, when certain contemplated railway and harbour works at Fishguard, Pembrokeshire, are completed by the Great Western Railway of England. It is to be remembered that the distance from Greenore Point, 2 miles east of Rosslare Harbour, to St. David's Head is only 49 miles, while that from Rosslare to Fishguard is about 60 miles. In this connection it is interesting to note that the so-called "English Baronies" of Forth and Bargy, which reach south from Wexford to the sea-coast at Carnsore Point and Crossfarnoge Point, were colonized from South Wales many hundred years ago. "The countye of Wexford," wrote Sir Henry Wallop in 1581, "was the fyrst place our nation landed and inhabited in. To this day they generally speake oulde Englishe."

From Rosslare a panoramic view of the entire south-east of Ireland may be obtained in clear weather. The coast-line can be traced northward to Cahore Point. Then in order from right to left Croghan-Kinsella Mountain (near Shillelagh), Lugnaquilla, Slieve Bay (near Ferns and Camolin), the range of Mount Leinster, Blackstairs Mountain, the White Mountain, and in the immediate foreground the mountains of Forth all come into view.

The only drawback to Rosslare as a seaside resort is the limited house and lodging accommodation. The owner of the property is

an absentee, and a sufficiently good title is not forthcoming to encourage capitalists to build. The Rosslare and Fishguard branch of the Great Southern and Western Railway of Ireland runs from Wexford Quay to Rosslare Harbour, a distance of $8\frac{3}{4}$ miles. By it large numbers of passengers are carried daily during the summer and autumn, the dry and breezy sands of Rosslare being deservedly popular with the people of Wexford and its vicinity.

KILMORE QUAY.

Kilmore Quay is situated close to Crossfarnoge or Forlorn Point and due north of the Saltee Islands, about 12 miles south of the town of Wexford. Having a southerly slope, Kilmore may be regarded as mild, and northerly winds are not much felt. There is however but little protection from winds blowing from due east. The soil is porous and sandy, so that the rain that falls is absorbed rapidly. The air is very bracing and pure, coming straight from the Atlantic. There is very imperfect accommodation for bathing. The strand towards the west on the Ballyteigue side slopes suddenly, so that at high tide bathing is dangerous except for those who can swim. The water however is splendid, clear and strong, and when the tide is out there is a beautiful even sandy bottom, running out for some 50 or 60 yards, and not exceeding 8 feet in depth. There is not much fog, and the weather is on the whole fine. The prevailing winds are westerly and south-westerly. The water supply is derived principally from wells in the village, and is of good character and quality, with a slight excess of chlorides.

As a seaside resort Kilmore Quay is usually visited during the months of June, July, August and September. The lodging accommodation is fair, though the houses are small and the number is inadequate. As a health resort it is suitable for most cases of chest delicacy, including consumption, except where hæmoptysis is a prominent symptom. Convalescents from tedious illness do very well. So also do those who suffer from the effects of overwork and worry, with insomnia. Strumous cases are greatly benefited. Epidemic diseases are of rare occurrence. Very good mackerel fishing can usually be had during the month of August.

COUNTY WATERFORD.

THE CITY OF WATERFORD.

Waterford (lat. 52° 16' N.; long. 7° 7' W.), on the south-west bank of the river Suir, is a county of a city and a Parliamentary borough. It is 97 miles south-south-west of Dublin. Its population in 1901 was 26,743; that of the Parliamentary borough being 27,713. The city is connected with its northern suburb of Ferrybank by a wooden bridge of 39 arches, 832 feet in length, spanning

“The gentle Shure that, making way
By sweet Clonmell, adornes rich Waterford.”—SPENSER.

The city of Waterford derives its name from its founders, the hardy Norsemen, who called it *Vadrefjord*. The Danish invasion took place in the ninth century, when “the ploughers of the sea” seized the mouth of the Suir and fortified a little delta some 20 acres in extent, the site of the present city. In 1171 Strongbow landed at Waterford, defeated the Danes and Irish, and sacked the town. A conspicuous and historic object is Reginald’s Tower, standing on the quay. It bears the following inscription:—“In the year 1003 | this Tower was erected | by REGINALD the DANE | . In 1173 it was held as a Fortress | by STRONGBOW, Earl of Pembroke | . In 1463 by Statute 3^d Edward 4th | a Mint was established here. | In 1819 it was Re-edified in its | original form and appropriated to | the Police establishment | by the Corporate Body of | the City of Waterford | . Rt. Hon. Sir John Newport, Bt., M.P., Mayor | . Henry Alcock Esq^r., William Weekes Esq^r., Sheriffs” | .

“Reginald the Dane” was son of Sigtryg (Sitrius), the great Danish king of Dublin and Fingall (the Fair Strangers) whom Brian Boromhe defeated at the Battle of Clontarf, on Good Friday, April 24, 1013.

The most interesting of the ancient ruins of Waterford is the Holy Ghost Friary, which was founded in 1240. The style is early English. The Leper Hospital dates from the visit to Ireland of King John in 1210. The sovereign landed at Crochor Crook, on the western shore of Waterford Harbour, and spent two months in the country.

Waterford was the one place in Ireland which successfully resisted the victorious arms of Cromwell. Hence it received from the Cavaliers the name "Urbs intacta," but the term really dates from 1493, when King Henry VII. sent the citizens a letter of thanks for their successful resistance to Perkin Warbeck and the Earl of Desmond, and permission to use as a motto the words "Intacta manet Waterfordia."

Although Waterford is a mountainous county, the neighbourhood of the city is rather flat. The banks of the Suir however rise to a considerable height and are well wooded. Below the city this noble river flows eastwards through a winding yet navigable channel until opposite Cheekpoint, distant some 6 miles, it joins the river Ross, formed by the confluence of the rivers Nore and Barrow, flowing southwards. At Cheekpoint a grand panorama unfolds itself. In the distance towards the west and north-west rise the Knockmealdown and Comeragh Mountains, the many-peaked Galtees, and

"Sweet Slievenaman, the darling and pride,
With soft flowing bosom and brow like a bride."

In the foreground are the broad waters of Waterford Harbour formed by the confluence of the Suir, the Nore, and the Barrow. These three rivers are called "The Three Sisters" because of their rising in the same mountain range—the Slieve Bloom Mountains in the Queen's County—while they join each other near the sea after flowing far apart through many different counties.

Spenser, in *The Faërie Queene*, speaks of these rivers as *sons* :—

"These three faire sons, which being thenceforth pourd
In three great rivers ran, and many countreis scourd.
The first the gentle Shure that, making way
By sweet Clonmell, adornes rich Waterford ;
The next, the stubborne Neure whose waters gray
By faire Kilkenny and Rosseponte boord ;
The third, the goodly Barow which dooth hoord
Great heaps of salmons in his deepe bosóme :
All which long sundred, doe at last accord
To ioyne in one, ere to the sea they come ;
So, flowing all from one, all one at last become."¹

Along both the western and the eastern shores of the large and secure estuary of Waterford Harbour are several places of

¹ *The Faërie Queene*, Book IV. canto xi. 42 and 43.

archæological and historic interest, as well as some sheltered watering-places. Passage East, 8 miles from Waterford, now a fishing village, was reduced by Cromwell in 1649. The old mole still stands. Nearer the sea, on the co. Waterford, or west side, are the ruins of "New Geneva" (founded by a colony of Genevese in 1785, and garrisoned with Hessians in the rebellion of 1798); Crook, where King John landed; and Dunmore East, a secluded and charming little watering-place. On the co. Wexford, or east side of Waterford Harbour, are Dunbrody, with splendid remains of an abbey and Cistercian monastery, dating from the twelfth century; Ballinakill House, where James II. spent his last night in Ireland; the village watering-place of Duncannon Fort; and at the extreme southern end of the promontory of Hook Head a tower 100 feet high—the Tower of Hook—attributed to Reginald the Dane. When Strongbow heard of this Tower of Hook, with Crook (Norse, *Krok* = a nook) on the western side of the estuary, he is alleged to have exclaimed, "I will take Waterford by Hook or by Crook." Hence a well-known proverbial phrase.

At Brook Lodge, Waterford, the rainfall in 1899 was 41.06 inches on 167 days; in 1900 it was 47.79 inches on 197 days.

A few miles to the southward of Waterford are two watering-places, which only require to be known to become popular—these are Tramore and Dunmore.

TRAMORE.

Tramore (population, 3,625) is 7 miles south by west of Waterford. It stands on the face of a steep hill, rising to an extreme elevation of 220 feet, at the western extremity of a three-miles stretch of sandy beach, from which the town takes its name (Celtic, *Tramore*, the great strand). It is a favourite seaside resort, frequented by Waterford folk in particular during the summer months. Dr. E. A. Stephenson, the Medical Officer of Health for the district, has favoured me with the following details. Tramore is sheltered from all, except easterly, winds. The district is hilly. The soil dries very quickly. Rain falls frequently, but the amount varies very much from year to year. Fogs are rare. The prevailing wind is south-west. Frost seldom occurs, and never

lasts long. Veronicas, fuchsias, yuccas and such-like plants grow freely in the open. The weather is generally mild up to Christmas. Spring is the most trying season. The drainage is very good, the system adopted being piped sewers to the Back Strand, a large lagoon shut off from the sea by a narrow strand called the *Burrows*. The water supply is good; it is derived from the open country. Bold and precipitous cliffs stretch south-easterly from Tramore to Great Newtown Head, the bay terminating on the east side in similar cliffs at Brownstown Head.

The health of Tramore is satisfactory. The climate tends very much to prolong life, so that senile decay and old age are very common causes of death. Influenza has shown an epidemic tendency from time to time during the last eight or ten years. Renal diseases, rheumatism, skin diseases, and endemic diseases are all rare. Diphtheria is unknown. All cases of debility are greatly improved by a residence at Tramore. Anæmia is absent among the residents, and visitors suffering from this condition improve quickly. Pulmonary phthisis and other tubercular diseases are rare among residents. Visitors suffering from these affections are usually much benefited. "Epidemic catarrh" is the only prevalent disease of the respiratory organs.

DUNMORE EAST.

Dunmore East (population about 400) nestles in a rocky bay on the western shore of Waterford Harbour, 10 miles by road from the city and 9 miles east of Tramore. Although very sheltered, it is bracing, and a short walk carries the visitor to cliffs from which the open Atlantic may be seen a short distance off. The rock formation at Dunmore is curious. It consists of cliffs, in which are many caves, built up of strata of Old Red Sandstone, which contrasts with the green of the adjacent herbage and foliage, the yellow of the sand along the beach and the dark blue waters of the estuary. South of the village stand the ruins of an old round tower, and also a large prehistoric earthen fort or *dun*, whence the place derives its name—Dunmore. There are facilities for sea-bathing and baths, and sailing, boating and fishing are favourite amusements of the summer visitors, who enjoy the unconventional life of this quiet and secluded watering-place. It

is reached by road from Tramore or Waterford, or by steamer during the summer months from Waterford and Passage East. There is a pier 600 feet long, with a lighthouse. *Merlin's Cave* is reached by a path leading from a steep cliff called the *Black Knob*. Further on, a cliff walk leads past the *Bishop's Hole* (100 feet above the sea) to the *Swine's Head* and *Falskirt Rock*.

BONMAHON.

Bonmahon (population, 120) is at the mouth of the small river Mahon, which rises on the southern slopes of Knockanaffrin, 2,478 feet, one of the loftiest summits of the Comeragh range, and flows southward by Kilmaethomas. The stream descends rapidly, reaching the sea five miles south of Kilmaethomas. There is good bathing at Bonmahon, which should possess an added interest for the medical profession as forming part of the estates of Sir Patrick Dun, the first President under the charter of William and Mary of the King and Queen's College of Physicians (1692), now the Royal College of Physicians of Ireland.

From Waterford, the Waterford, Dungarvan and Lismore Railway affords a ready means of approach to Bonmahon, *via* Kilmaethomas. The line is throughout most picturesque. At first it runs along the southern bank of the river Suir. It then passes through and indeed over the foot-hills of the Comeragh Mountains, which rise to some 2,500 feet some five miles north-west of Kilmaethomas. From this place the line descends rapidly to Dungarvan, prettily situated on the shores of Dungarvan Harbour, which is bounded on the south by the bold promontory of Kelvick Head.

DUNGARVAN.

Dungarvan (population in 1901, 4,850) is a large and prosperous town of great antiquity, standing at the mouth of the Colligan river, a mountain torrent which rises on the south-west slopes of Coumshingaun (2,443 feet), the most southern member of the Comeragh range. The town is built along the bay of the same name, the shores of which afford good bathing at high water.

The Colligan river flows through a beautiful ravine, bordered with dense woods of birch and fir, which is within easy distance of Dungarvan. On the eastern shore of the harbour is Abbeyside, connected with the town by a causeway and a one-arched bridge of 75 feet span across the Colligan river. The causeway and bridge are together 1,120 feet long. They were erected in 1815 by the Duke of Devonshire, lord of the soil, at a cost of £50,000. Interesting ruins are the chief attraction of Abbeyside. Dungarvan Harbour is bounded on the south by Helvieck Head, which shelters the bay and town from the open Atlantic. Dungarvan is prettily situated, and is easily reached from Waterford on the east or from Mallow on the west by what is now a branch of the Great Southern and Western Railway. Its great attraction is the beautiful Atlantic landscape, and the almost ceaseless roar of the much-resounding sea—(“*πόλυφλοισβοιο θαλάσσης*”).

ARDMORE.

Ardmore (population, 270), 14 miles south-west of Dungarvan, stands under the shelter of Ardmore Head on the bay of the same name. It is 9 miles east of Youghal. It is an out-of-the-way, old-fashioned little watering-place, interesting to antiquarians by reason of its ruins, which include a very perfect round tower, 97 feet high, a cathedral, a church, an oratory, and a well—all called after the patron saint of Waterford and early missionary, St. Declan, to whom St. Patrick entrusted the conversion of the Desii. Whiting Bay lies west of Ardmore Head. Into it the river Blackwater formerly flowed, whereas now it empties itself into Youghal Bay. Spenser, in his *Faërie Queene*, wrote:—

“Past Lismore the Avonmore doth flow,
And Ardmore sees it to the ocean go.”

YOUGHAL.

Youghal (population in 1901, 5,393), (Celtic, *Eochaille*, yew-wood) is an interesting and quaint old town, built on the side of a partly wooded, partly rocky height, Knockvarry Hill, overlooking the estuary of the river Blackwater. It is a fashionable watering-place, and possesses a fine esplanade and strand, along which villas

and cottages have been built within recent years. The older part of the town faces eastward, the sea-front southwards. Its geographical position is lat. 51° 57' N., long. 7° 52' W., 157 miles south-west from Dublin, and 27 miles east of Cork. The harbour or estuary is unfortunately obstructed by a bar, which forbids the entrance of vessels exceeding 400 or 500 tons burden. There is however a good fishery, which employs many hands. Youghal is an old-world town, with a lofty clock-gate tower spanning the roadway in the centre of the main street, which is more than a mile in length.

The parish church is formed of the nave and isles of the ancient collegiate church, built by the eighth Earl of Desmond in 1464. Sir Walter Raleigh's house, now called Myrtle Grove, is still extant. Raleigh was chief magistrate of Youghal in 1588-89, and he entertained the poet Edmund Spenser in this very perfect example of an Elizabethan gabled house. In the adjoining garden the potato was grown for the first time in Ireland, and Raleigh's yew-tree, beneath which the knight is said to have "drunk tobacco," is still pointed out. The interior of Myrtle Grove is remarkable for its beautiful oak wainscoting.

No description of Youghal would be complete without a reference to the beautiful Blackwater—often called the "Irish Rhine," a name which is no compliment to the lovely scenery of the reaches of the river between Youghal and Cappoquin and between Cappoquin and Lismore.

This river—mentioned by the poet Spenser as

"Swift Awniduff, which of the English man
Is cal-de Blacke-water"—¹

rises on Slievegher, on the borders of the counties Cork and Kerry. From its source it flows at first eastward past Mallow, Fermoy and Lismore to Cappoquin, where it suddenly curves southward to enter the sea in Youghal Bay. Its course is about 100 miles, and it flows through some of the loveliest scenery in Ireland. Spenser, perhaps, did not know that "Blackwater" is a literal translation of "Awniduff"—"Awni" or "Anna" being the Irish *cunagh*, a marsh, and "duff" being a form of "*dubh*," black.

¹ *The Faerie Queene*, Book IV. canto xi. 41.

During the summer season a steamer leaves Youghal daily for Cappoquin, 17 miles inland and due north.

An iron bridge spans the Blackwater at the head of the estuary. It was built in 1880 to replace a bridge of Memel fir, built in 1829 by Nimmo, the engineer. The bridge consists of 622 feet of 30 feet spans, and 661 feet of five large spans each of 100 feet, with 50 feet on each side of the pier for the passage of vessels. A causeway, 485 feet long, connects the bridge with the land, the total length being 1,768 feet. The river proper is entered just above the bridge, and a succession of charming and romantic views is met with throughout the sail to Cappoquin. Passing on the left the wooded hill and ruined Knights Templars' Castle of Rhincrew (Irish, *Rinn-cruic*, Bloody Point), founded by Raymond le Gros in the twelfth century, the steamer soon comes within sight of Templemichael church and the adjoining old castle of the Geraldines at the confluence of the Glendine river with the Blackwater.

The last of these Geraldines was buried at Ardmore, far from his young bride, who lost her life in the siege of Templemichael Castle by Cromwell and his regicide followers. A plaintive legend tells how after his burial through seven long years the awestruck peasants nightly heard his voice clearly calling across the river, in the tender Gaelic tongue, "Garault, come to me!"—"Gerald, a ferry!" At last, some young men of his clan went to Ardmore, exhumed his body and carried it to Templemichael, where they laid it in his young wife's tomb. Henceforth his spirit no more troubled the silent vigils of the fishermen at night.

The beautiful seat of Ballynabray ("the town of the strand") occupies the slopes on the left bank of the river between its tributaries, the Glendine and the Lacky. Close by are the ruins of Molana Abbey, the burial-place of Raymond le Gros. Higher up, the river widens into the Broads of Clashmore, in which the tidal flow spends itself and ceases. Seven miles from Youghal, on the left bank, the ruins of Strancally Castle are perched on a rocky crag overlooking the river. Weird tales are told of a cave in this crag, called by the country-folk the "murdering-hole." One of the Lords of Desmond, nicknamed "the Brigadier," is said to have been in the habit of despatching his guests when they were merry with wine in this cave for the sake of usurping their inheritances.

New Strancally Castle and Headborough House are situated near the confluence of the Bride with the Blackwater. Above this meeting of the waters is Camphire House, opposite to Villierstown, a small village near the right bank. A small wooded island and Dromana Forest on the same side of the river are then passed, when Dromana House comes into view. In the grounds are the ruins of an old castle of the Earls of Desmond, in which was born Catherine, commonly called the old Countess of Desmond, who is reputed to have lived to the age of 140 years. Affane House is passed at 15 miles. Here was born, in the seventeenth century, Valentine Greatorex, who attained celebrity through his supposed miraculous power of curing diseases by stroking—an anticipation of the modern massage. Here also Raleigh planted the first cherry-tree in Ireland. Mount Rivers and Tourin are neighbouring mansions. Higher up are the ruins of Norrisland Castle, once the residence of the Greatorex family.

CAPPOQUIN.

Cappoquin (population, 1,366) is beautifully situated at the bend of the Blackwater (from east to south), 17 miles from Youghal. As it is approached by river-steamer the lofty range of the Knockmealdown Mountains is seen towering above it far to the northward. The summit-level of these fine hills is 2,609 feet. On their southern slope stands, at a height of 650 feet, the well-known Monastery of Mount Mellary, founded by the Trappist monks after their expulsion from France in 1830.

LISMORE.

Lismore (population, 1,632) stands on high ground, south of the Blackwater, 4 miles higher up the river from Cappoquin. The river scenery between the two places is charming. To the east of the town is a rath, whence the name *Lis Mor*. Great Fort. The place is of vast antiquity, and was the seat of a bishopric probably as early as the seventh century. In A.D. 631. St. Carthage, of Rahau, fled thither and founded the See. Lismore Castle, the splendid Irish residence of the Duke of Devonshire,

stands in a commanding position close to the river, which it almost overhangs. The views from the castle windows are magnificent, looking up and down and across the river to the Knockmealdown Mountains towards the north. The old fortress was the residence of the Bishops of Lismore until 1589, when Archbishop Myler Magrath granted it to Sir Walter Raleigh, who shortly afterwards sold it to Richard Boyle, the founder of the House of Cork and Orrery, and fitly styled the Great Earl of Cork. His seventh son, the Hon. Robert Boyle, one of the founders of the Royal Society, was born at Lismore, January 25, 1626. On the death of the fourth Earl of Cork, in 1753, Lismore Castle passed into the possession of Lady Charlotte Boyle, wife of the fourth Duke of Devonshire and ancestress of the present Duke.

Lismore offers many attractions to the wayfarer and health-seeker. As the town stands so high, the air is not moist and relaxing as it would be in the river valley. It is the centre for the famous salmon-fishery of the Blackwater; it is easily reached by rail, and has more than one excellent hotel. The Devonshire Arms Hotel, which is now under the management of the Estate Office, is within a few minutes' walk of both Lismore Castle and the railway-station. Hunting, boating, fishing (salmon and trout), and golf may all be had. There is an excellent posting establishment connected with the hotel, and excursions may be made in all directions from Lismore as a centre.

COUNTY CORK.

The coast-line from Youghal to Cork presents a succession of splendid sea-cliffs, fiords, and strands. The chief town along this coast is **Ballycotton** (population, 544), on the bay of the same name, and sheltered from the south wind by a cliff 185 feet high. Ballycotton Bay extends some 8 miles in an east-north-easterly direction, terminating at Knockadoon Point and Capel Island, which form together the south-west boundary of Youghal Bay. The most southerly point between Youghal and Cork Harbour is Power Head (145 feet), which derives its name from the Norman family, De la Poer. About a mile west-south-west of this headland is a hamlet called Gyleen (population, 268), the climate of which is fully represented by the meteorological

table relating to Roche's Point, Cork Harbour, from which it is distant nearly 3 miles towards the east.

THE CITY OF CORK.

Cork (Celtic, *Corrach*, a marsh), the capital of the province of Munster, a county of a city, and a Parliamentary borough, stands on the river Lee, 159 miles south-west of Dublin, in lat. 51° 45' N.; long. 8° 20' W. In 1901 the population of the municipal borough was 75,978, inhabiting about 15,000 houses. According to the *Annals of the Four Masters*, the ancient city was founded by Lochan the Fairhaired (St. Finbar) in A.D. 622 at Gill Abbey Rock, where the Queen's College now stands. On the lintel of the College runs the legend, "Where Finbar taught, let Munster learn." In 821 a Danish fleet appeared in Lough Mahon, the wide-spreading estuary of the Lee, and burned the city. In 1012 the Danes built a new city lower down the beautiful wooded valley where the Lee divides into two channels and forms an island—as Spenser says—

"The spreading Lee that, like an Island fayre,
Encloseth Corke with his divided floode."¹

The site of the new Danish town was an alluvial marsh. The greater part was built on the long island between the streams, and to this day the centre of the city occupies this position, being largely supported on piles and arches.

Cork is beautifully situated. Westward stretches the wooded valley of the Lee. Eastward the valley opens so as to form the shores of Lough Mahon. Southward the ground rises gradually through a rich country of cornfields and meadows. Northward a steep hill reminds one of Bristol, at the same time protecting the city from the northerly winds and entrapping the sunshine in the river valley. It is a busy, well-to-do place, with four miles of quays and splendid granite quay walls. "The town," writes Lord Macaulay in his masterpiece *The History of England*, "is adorned by broad and well-built streets, by fair gardens, by a Corinthian portico which would do honour to Palladio, and by a Gothic college worthy to stand in the High Street of Oxford. In 1689

¹ *The Faerie Queene*, Book IV. canto xi. 44.

the city extended over about one-tenth part of the space which it now covers, it was intersected by muddy streams, which have long been concealed by arches and buildings. A desolate marsh, in which the sportsman who pursued the water-fowl sank deep in water and mire at every step, covered the area now occupied by stately buildings, the palaces of great commercial societies."

Deficient in the matter of parks and squares, Cork nevertheless has two recreation-grounds—the Mardyke Walk and "Bank Field" near the Western Road towards the west-end of the city, and the Marina, a fashionable promenade lined with trees running along the south bank of the Lee towards the east, near the Cork Park and Race-course, of some 240 acres. However, the open country is so near the centre of the city on all sides that the want of "lungs" within the boundary is not materially felt.

There are many fine churches and public buildings. St. Finbar's Cathedral (Church of Ireland) is a modern structure in the early French Pointed style. The central tower and spire rise to 240 feet. Shandon Church (St. Anne's) was built in 1722 on the hilly rise of the north side of the city. Its singular tower, 120 feet high, is surmounted by a graduated turret of three stories, the southern and western sides being faced with white limestone, the northern and eastern with red sandstone: hence the distich:—

"Parti-coloured, like Cork people,
Red and white, stands Shandon steeple."

A short distance north of Shandon stands St. Mary's Roman Catholic Cathedral, built in 1808 in the Gothic style. It has a lofty tower with a fine peal of bells.

St. Mary's Dominican Church on Pope's Quay is even more beautiful, and its Grecian portico, to which Lord Macaulay alludes, with six Ionic columns supporting the entablature, is especially graceful. Other public buildings are the Courts of Justice, the Municipal Buildings of Science and Art, the Royal Opera House, and the Queen's College, on the Western Road, standing on the site of St. Finbar's ancient monastery at the Gill Abbey Rock.

To Dr. Philip G. Lee I am indebted for the following Report on the general characters of the district of Cork, including a radius of 20 miles around the city:—

"The dominant topographical feature of the district around Cork is the existence of a system of ridges and valleys which run in nearly parallel lines in an east and west direction quite across the country. This feature is connected with a similar arrangement of the main river channels; and the lines of communication and other artificial features show a prevalent tendency to accommodate themselves to this natural system.

"The most important of these ridges is the one to the north of Cork, its watershed being about 10 or 12 miles distant from the city. Its breadth from the edge of the Blackwater valley to the Lee, including the foot-hills, is more than 15 miles. Its general height north of Macroom is about 2,000 feet: but it sinks to the *eastward*, and north of Donoughmore is not more than 800 feet high. It rises again, however, until in the Nagle Mountains, about 14 miles north of Cork, its altitude reaches 1,400 feet. Its surface is generally moorland, with thin patches of mountain bog in the higher portions.

"The ridge south of Cork is lower and narrower than the main northern one. Its breadth is about 3 miles, and its height to the south of Cork varies from 400 to 500 feet or upwards. The summit level is 578 feet. The moorland character prevails; but there is little bog, and much of the moorland is very fertile for tillage.

"The valley in which Cork is situated averages about two miles in width, omitting the foot-hills to the north and south. Its general altitude, even for a long distance up the river Lee above the city, is under 100 feet.

"The minor valley which extends from Macroom to Blarney is not so regular or so wide, and its floor stands at a height of 150 feet or more.

"The district to the south of the Clara Hills (which lie between the Lee and Bandon rivers) is rather a broad and somewhat undulating plain than a valley. Its general altitude is about 200 feet. The valleys elsewhere are fertile, but the one now under consideration cannot be said to be so. In this instance, however, the absence of fertility might be explained by the character of the underlying rocks.

"The main streams all flow towards the east, being fed by tributaries which flow from the north or south down the flanks of

the main ridges towards the valleys. The river Lee, which rises in and near Lough Gouganebarra on the borders of Cork and Kerry, is the outlet for most of the drainage, and its markedly extended estuary receives nearly all the water which does not flow into it higher up.

"The ridges have been carved out of anticlinal folds of the Dingle beds, a set of sandstones and sandy slates belonging to the lowest portions of the Old Red Sandstone. These rocks are fairly durable under atmospheric influences.

"The floors of the main east and west valleys are generally of limestone lying in synclinal triangles. The plain to the south of the Bandon river consists however of carboniferous slate, a fairly soft rock which contains harder portions here and there, where the intermixture of sand with the original mud has been large.

"The drift is very thin or absent over most of the district, being found in quantity only in a few of the deeper valleys. Its general character is sandy and gravelly."

Mr. James Porter, who kindly helped in the drawing up of this Report, states that at the source of the Bandon river is a spot which might well be used as a health resort.

Dr. Lee states that the prevailing winds in Cork are south-west and west, very frequently veering to north-west, and more rarely backing to east. South-east is a very frequent wind in spring.

There is constantly a considerable amount of dampness, but rarely much heavy fog. Rain falls frequently. Sunshine is present throughout the year. Frost is very slight, ice rarely lasting longer than two days or so at a stretch.

The average temperature is warm all the year round. The climate in general is humid and relaxing.

Vegetation is generally abundant. Certain parts, chiefly overlying the limestone, such as Carrigaline, are excellent for the fattening of cattle.

As to the therapeutic effect of the climate, Dr. Lee believes the climate to be beneficial in cases of stone and gravel. Also some districts facing south, as Queenstown, are favourable for chest complaints. The want of a more bracing atmosphere is a great drawback. For sea-bathing many charming places are available within an easy distance of Cork, but the generally bad state of the lodgings, and the want of properly adapted bathing-

strands and bathing-boxes, make them really available only to the robust in health who can put up with a good deal of roughing.

Dr. Lee has made the following health report on Cork city, and a radius of 20 miles around:—

I. A. Anæmia and Debility.—Both these complaints are frequently met with by me in my practice at the Women and Children's (County and City) Hospital. Most of our cases suffer more or less from anæmia. It is of course noticeable in the work-house—from the poor food obtainable by the very poor in the outlying districts. But I think anæmia is more common in Cork than in most other places.

Debility.—A peculiar feeling of “want of tone” is noticed by nearly every inhabitant of Cork (especially the city). It has no effect apparently on the length of life, but is apparent to every one, especially to those who come to Cork from a more northern climate. I have never heard a special reason for this.

B. Scrofula and Tuberculous Diseases are very numerous, especially in the south and west of Cork county. This is attributable possibly to the amount of intermarrying that goes on amongst the country folk.

C. Diseases of the Respiratory organs.

Phthisis is very frequent amongst all classes of the community especially in certain districts such as Crosshaven. This is difficult to account for in the seaside localities. I think it more frequent in the seaside places towards the south-east of Cork, especially if the residences of the inhabitants face the north or north-east. Queenstown and other places facing south seem to be less visited with phthisis and chest disorder. In the District Lunatic Asylum phthisis is particularly fatal. *Hæmoptysis* though frequent, is not at all in proportion to the number of cases. The common phthisis of this district is of the low lingering type, not generally very rapid.

Bronchitis and Catarrh are of frequent occurrence.

Pneumonia.—As a rule cases of pneumonia are few and far between, but occasionally in the early spring many and rapidly fatal cases occur. In the spring of 1898 there was such an epidemic (if it could be called so).

Pleurisy is not very frequent.

Asthma is common among the residents. Among visitors too the district seems to aggravate this complaint.

D. Renal Diseases.

Acute Renal Dropsy is very infrequent: so also is *Chronic Albuminuria*.

Calculus and Gravel.—In this district among the inhabitants *stone* is but very rarely met with. Indeed one might almost say that the district itself is free from this disease, the few cases that occur, as for example among the military, being nearly all imported ones.

E. Rheumatism, both of the acute and chronic variety, is very frequent. *Neuralgia* also is common.

F. Diseases of the Skin.—These are not common, nor are any unusual varieties seen.

G. Endemic Diseases.

(1) *Malarial affections* are not common.

(2) *Typhoid fever* is very common, chiefly in the late autumn.

(3) *Diarrhoea* is also very common, and of a severe type in late summer and autumn.

(4) *Scarlet fever* can scarcely be called endemic; though now and again it is prevalent in epidemic form.

(5) *Diphtheria* is not by any means endemic. The conditions favourable for this disease I look upon as present, especially about November, but the complaint is really infrequent. This is explainable from the fact that compulsory school regulations are not in force in Cork. Epidemic cases have occurred lately in Monkstown, Cork Harbour.

(6) *Relaxed sore throat* with post-nasal troubles, catarrh and adenoids are common.

(7) *Typhus fever* is still (but not to any great extent now) endemic. However it is rare that the two fever hospitals are without cases of typhus from either the city or the county. Of late years the poorer dwellings in the city have been greatly improved, and the number of people living in the central districts (or "the marsh" so-called) has become much less, so that Cork now, I may say, is without a hot-bed of typhus.

(8) There are many cases of *Trachoma* and *Punaris* in the county of Cork, chiefly from the south and western districts.

II. It is hard to state definitely the common causes of death.

The inhabitants are, as a general rule, long-lived. The average stress of mind and body is less in daily life in Cork than in more active business centres, though the poverty of the very poor is greater. In consequence of the improved state of the Union Hospitals, the lives of the poor are considerably prolonged. Taking the average of the professions in Cork, the lives of professional men are generally prolonged.

III. The system of drainage at present chiefly in use consists of drain-pipes with water-flush, air-traps being inserted at intervals. In the older part of the town, however, the drainage is not satisfactory, but the Corporation is doing its best to remedy this, as far as possible, by causing all landlords to put flush-closets into their houses. Of late too, in order to secure good drainage, the improved dwellings for the poor have been built on the Hills.

THE FOLLOWING TABLE SHOWS THE RAINFALL AT CORK DURING THE YEARS 1895-1900.

RAINFALL AT QUEEN'S COLLEGE, CORK.			RAINFALL AT CORK CITY (THE PALACE).			RAINFALL AT WELLESLEY TERRACE, CORK.		
Rain-gauge Diameter, 8 inches. Height above Ground, 1 foot. Height above Sea-level, 60 feet.			Rain-gauge Diameter, 5 inches. Height above Ground, 1 foot. Height above Sea-level, 40 feet.			Rain-gauge Diameter, 5 inches. Height above Ground, 1 foot. Height above Sea-level, 190 feet.		
Year.	Inches.	Days on which '01 or more fell.	Year.	Inches.	Days on which '01 or more fell.	Year.	Inches.	Days on which '01 or more fell.
1895	49·68	184	1895	47·49	179	1896	31·49	182
1896	32·22	179	1896	26·58	156	1897	44·36	213
1897	44·89	221	1897	42·96	198	1898	33·80	222
1898	35·64	192	1898	35·80	192	1899	41·85	203
1899	47·01	182	1899	44·97	191	1900	35·41	208
1900	40·00	220	1900	36·60	207			
Average 6 years 1895-1900.)			Average 6 years 1895-1900.)			Average 5 years 1896-1900.)		
41·56			39·57			37·98		
196			187			206		

IV. The water supply is very abundant, and fairly good. The water is supplied from the Lee about a mile above the town. The Medical Profession some years ago drew attention to impurities above the intake, both from Ballincollig and the Lunatic Asylum, also further off from Macroom. The filter-tunnel at that time was found to be imperfect. The Water Works Committee have since then done their best to remove the evils complained of, and have succeeded in a great degree. Still the water supply is not

ideally perfect. Most of the residents boil the water before using it. The City Water Works were erected, in pursuance of the provisions of local Acts of Parliament obtained between 1852 and 1856, at a cost of £100,000 sterling. The supply is 5,000,000 gallons daily. There are 625 hydrants and 166 public fountains. The main pipes extend to 59 miles; there are about 66 miles of service pipes.

The neighbourhood of Cork is rich in health resorts. Inland, and at a distance of 18 miles north-north-west, is beautiful Mallow, on the Blackwater. Much nearer, 5 miles north-west, is Blarney, with its groves and famous castle. South-east of the city, the shores of Lough Mahon are thickly set with pleasant suburbs and watering-places, while Queenstown, overlooking Cork Harbour, enjoys a world-wide reputation for salubrity and the mildness of its climate.

MALLOW.

Mallow (population in 1891, 4,366) is charmingly situated on the north bank of the Blackwater, 150½ miles south-west of Dublin, and about 18 miles north-north-west of Cork. A bridge of three arches joins the town to its suburb of Ballydaheen on the south side of the river, the banks of which are beautifully wooded. The Irish name of Mallow is *Magh-Ealla*, that is "The plain of the river *Ealla* or Allo." The stream now called the Allow is a tributary of the Blackwater, flowing into it through Kanturk about 10 miles west of Mallow.

"Strong Allo tombling from Slewlogher steep ;

And Mulla mine, whose waves I whilom taught to weep."¹

Mallow possesses a sub-thermal spring, the temperature of the water being 70° to 72° F. Baths and a spa-house were built by the lord of the soil, Sir Denham Norreys, in the eighteenth century. There is an important railway-junction at Mallow, a branch line from the main line of the Great Southern and Western Railway from Dublin to Cork, running eastward to Fermoy and Lismore, and another branch running westward to Killarney and Tralee. The views round Mallow are beautiful. In the distance towards the north-east are the Ballyhoura Hills—the "Old Father Mole" of Spenser; the Galtees (3,015 feet) and the Kilworth

¹ *Faërie Queene*, Bk. IV. canto xv. 42.—SPENSER.

Mountains. Towards the south-east rise the Nagle Mountains near Fermoy, while in the south-west the Boggeragh range rises to 2,118 feet in Musheramore.

BLARNEY AND ST. ANN'S.

Blarney, a small town on the river of the same name (population, 808), is noted for its tweed manufactory. It is a favourite resort in the tourist season, having become known everywhere by the song of *The Groves of Blarney* written by Richard Milliken of Cork in 1798. Blarney Castle, 1½ miles from the railway-station, was built in 1446 by Cormac McCarthy. It stands on an isolated limestone crag, overhanging the confluence of the Blarney and Comane rivers. In its walls is the celebrated Blarney stone, of which Father Prout wrote in a supplemental verse to *The Groves of Blarney*.

St. Ann's Hill Hydropathic Establishment, Blarney, was founded in 1843 by the late Dr. Barter. It is most conveniently reached from Cork by the Cork and Muskerry Light Railway. Trains leave Western Road, Cork, for St. Ann's station six times a day, Sundays included.

This Hydropathic Establishment may be said to be the birth-place of the improved Turkish bath in Western Europe, and on the Continent the hot-air bath is often spoken of as the Roman-Irish bath. In 1856 Dr. Barter erected the first hot-air bath in Western Europe. The present spacious and handsome baths were erected in 1870 to meet the larger and increasing requirements of the visitors to St. Ann's Hill. The mildness and salubrity of the climate of Blarney and its neighbourhood make it an eminently suitable place for a health resort, and numbers visit it every year. The Hydropathic is picturesquely situated on rising ground surrounded by wooded hills and valleys, and with a south-easterly aspect. The principal rooms command a view of the far-famed Groves and Castle of Blarney, and of the rich valley of the "Shournagh," a fine sweep of pasture-land which gives breadth and variety to the landscape. The grounds are tastefully laid out, and the woods, some hundreds of acres in extent, afford sheltered and delightful walks. There is an unfailing supply of spring water celebrated for its purity.

Climate.—The elevated position of the house (250 feet above sea-level, on a dry sandy subsoil) and its openness to sunshine and the most favourable winds, ensure the circulation of a refreshing and healthful atmosphere. The temperature of the locality throughout the year is equable and remarkably free from sudden changes. The *winters* are exceptionally mild. As the district is mainly pastoral, and the nearest town (Cork) is 7 miles distant, the air is perfectly pure and free from contamination.

It has been already stated that the estuary of the Lee below Cork broadens into Lough Mahon. The waters of this wide expanse flow through a narrow strait into Cork Harbour. The scour of the water has deepened this channel, while its banks are steep and in places even precipitous. On the west side are situated Passage (West), Glenbrook, and Monkstown; on the east side, Carrigaloe and Rushbrook.

PASSAGE WEST.

Passage (West), so called to distinguish it from Passage (East) in Waterford Harbour, is the present terminus of the Cork and Passage Railway, $6\frac{1}{2}$ miles from Cork. From it steamers carry passengers to Queenstown, stopping at Monkstown pier on the way. In 1891 the population of Passage was 1,765. In the summer months it is considerably increased by an influx of visitors. Wooded slopes rise behind the town on the landward side, so that it is well sheltered even in winter.

GLENBROOK.

At **Glenbrook**, half-a-mile further on, there are extensive baths. A little way on the road to Monkstown towers a mass of rock, called the Giant's Stairs, within which the giant O'Mahony, who placed it here, is fabled to be sleeping spellbound by enchantment.

MONKSTOWN, CO. CORK.

Monkstown, 3 miles from Cork, stands at the mouth of an inlet of the sea, or "pill," which runs inland for about a mile. The town, surrounded with woods, faces south-east, so that it is most favourably situated. Monkstown Castle, built in 1636, is said

to have cost its owners only a groat (*i.e.* fourpence), because the wife of the lord of the soil in his absence bargained that the workmen employed in the building of the castle should obtain their supplies from her exclusively. This system of truck practice was so successful that on the completion of the work the expenditure exceeded the income by only fourpence. The lady in question, by name Anastasia Gould, wife of John Archdeckan, lived until 1689, so that for many years she enjoyed the fruits of her good management.

QUEENSTOWN.

Queenstown, formerly called the Cove of Cork, is most favourably situated on Great Island along the southern slope of a steep hill which rises quickly from the water's edge to a height of 305 feet. It is a municipal town, and in 1901 had a population of 7,887. The houses are generally well built and faced with cement, to protect them from damp caused by rain driven by the strong south and south-west winds, which are prevalent especially in winter. Queenstown is an important naval station, and the Government are at present erecting extensive docks at Haulbowline, one of three islands in the magnificent land-locked sheet of water, which is called Cork Harbour. The entrance to the harbour is about 2 miles long by 1 mile broad, and is guarded by Fort Camden on the western heights, and by Fort Carlisle on the eastern. The mouth of the entrance is at Roche's Point, 4 miles by water, south-south-east of Queenstown, where there is a lighthouse 49 feet high and 98 feet above the sea. At the Point there is also a signal-station of Lloyd's and the various trans-atlantic steamship lines. Here too is a telegraphic reporting station of the Meteorological Office, London. The following meteorological table (p. 457) has been compiled from the daily weather reports published by the Meteorological Office. It fairly represents the climate of Cork itself.

Cork Harbour itself, exclusive of the numerous creeks and bays which indent its picturesque shores, is 4 miles in length by 2 miles in breadth. It contains three islands, the property of the Crown—Haulbowline, already mentioned, lying just opposite to Queenstown; Rocky Island, excavated so as to serve as a

ROCHE'S POINT, CORK HARBOUR, LAT. 51° 47' N.; LONG. 8° 19' W.
43 FEET ABOVE SEA-LEVEL.

MONTHS.	Barometer at 8 a.m. Means. 1871-1895.	TEMPERATURE OF THE AIR. 1871-1895.							Rainfall Means. 1866-1895.	
		Dry Bulb. 8 a.m.	Wet Bulb. 8 a.m.	Daily Maximum.	Daily Minimum.	Maximum.	Years.	Minimum.		Years.
January	29.900	42.7	41.4	47.3	38.9	57	1889	20	1894	5.33
February	29.927	43.0	41.4	48.2	39.4	56	1887, 89	25	1895	4.19
March	29.930	43.3	41.5	49.7	39.5	60	1895	27	1890	3.38
April	29.873	47.0	44.7	53.8	42.4	72	1893	31	1892	3.06
May	29.964	51.8	49.0	58.7	46.3	70	1874, 76, 80, 81	36	1879, 86	3.01
June	29.983	57.0	53.8	64.3	51.3	80	1876, 87	41	1881	3.07
July	29.933	58.8	55.9	65.8	53.3	84	1876	45	1888	3.18
August	29.921	58.8	56.3	65.7	53.9	80	1880	44	1883	4.03
September	29.963	55.6	53.4	61.7	51.0	74	1880	39	1893	3.74
October	29.876	49.9	48.1	55.7	45.8	65	1880, 84, 86	32	1881	4.16
November	29.869	46.2	44.6	51.2	42.0	61	1875	27	1890	4.79
December	29.908	43.5	42.1	48.2	39.4	58	1873	25	1882	5.16
Means	29.921	49.8	47.7	55.9	45.3	84	1876	20	1894	47.10
506										

powder magazine and explosives store; and Spike Island, formerly a convict station, on which stands Fort Westmoreland.

Queenstown is an imposing-looking place when viewed from the harbour. Along the margin of the shore runs the beach which forms the chief thoroughfare. Here are the Queen's Hotel, the Royal Cork Yacht Club House, and the Great Southern and Western Railway station. In the middle of the town, at a considerable elevation, stands the Roman Catholic Cathedral of St. Colman, the patron saint of Cloyne. It is still in course of erection, having been commenced in 1868. The building is in the florid Gothic style, and will be surmounted by a tower 300 feet high. The views of the harbour from the streets and villas on the higher slopes of the hillside are splendid, and the air is delightful, if sometimes in too rapid motion to be appreciated. Westward, a

broad quay-wall, constructed by Lord Middleton in 1848, affords a grand promenade, extending more than a mile to Rushbrook, a suburb and a station on the Queenstown branch of the Great Southern and Western Railway.

Of Queenstown, Dr. Edgar Flinn, D.P.H., now a Medical Inspector of the Local Government Board for Ireland, wrote as follows some years ago in the *Dublin Health Record* :—

“The climate is remarkably mild and equable, and at the same time fairly dry and tonic, and is especially suitable as a winter and spring residence for persons with delicate chests, to sufferers from chronic catarrhal throat affections, and to convalescents from acute diseases. It is particularly appropriate as a seaside resort to persons requiring a soothing and sedative atmosphere. From the position of Queenstown, winds from the colder points are very little felt, and it is completely protected from the north, north-east, and north-west winds. The mean temperatures of the seasons are exactly similar to those at Torquay, the noted winter health resort in the south of England, and higher than those of Bournemouth, Hastings, and Ventnor. As a winter health resort Queenstown possesses all the best natural and climatic advantages.”

Queenstown was called Cove until 1849, when her Majesty Queen Victoria paid her first visit to Ireland, landing on August 3rd at what was then the Cove of Cork. To commemorate so auspicious an event the name was changed to Queenstown.

Crosshaven (population, 532) and Whitegate (population, 641) are small watering-places on the shores of Cork Harbour. Aghada (population, 185) is a short distance inland.

CROSSHAVEN.

Crosshaven is on the south-west side of the harbour, not far from Fort Camden and at the mouth of the Owenabwee (Owenbay or Owenboy) river. The Irish name of this beautifully-wooded stream means “Amber-water.” About a mile up the estuary towards Carrigaline, near the ruined castle of Aghamarta, there is a sheltered reach of the river called **Drake’s Pool**. Here Sir Francis Drake lay hid with his five sloops when pursued by the Spanish fleet in 1587. The Spaniards entered the harbour, but

failed to find their quarry and retired. Steamers cross and recross many times a day between Queenstown and Crosshaven, where there is an excellent modern hotel.

WHITEGATE AND AGHADA.

Whitegate and **Aghada** are situated on the eastern shore of the harbour, Whitegate south-east, and Aghada east-south-east, of Queenstown. From Aghada pleasant trips may be made to Rostellan Castle, formerly the residence of the Lords of Thomond, where there is a cromlech, and to Cloyne, the seat of an episcopal see, now merged in that of Cork (Church of Ireland), founded by St. Colman in the sixth century. A very perfect round tower 100 feet high stands near the cathedral, now used as the parish church. There is an interesting sail or boating excursion from Aghada to a hamlet called Ballinacorra, $4\frac{1}{2}$ miles from Midleton. There is no satisfactory sea-bathing at either Whitegate or Aghada.

Westward, or more strictly south-westward of Cork Harbour, the coast-line is indented with numerous bays and fiords which offer facilities for sea-bathing in summer, and nearly all of which are now easily reached by means of the Cork, Bandon, and South Coast Railway and its connections. The train services from and to Cork are timed to connect with the English and Dublin down and up mail trains. Intending visitors should obtain from the General Manager at the Cork terminus, Albert Quay, the official programme of Tourist Arrangements over this system of railways, coaches, and steamers.

KINSALE.

Kinsale (in Celtic *Ceann-saile*, the head of the Brine), a maritime town with a population in 1901 of 4,078, overlooks the windings of the river Bandon from its lofty perch on Compass Hill. It was an early settlement of the Anglo-Normans, and gives a title to the ancient family of de Courcy, ennobled in 1181. The present Baron Kingsale, Courcy and of Ringrone is the thirty-third in the succession. He is the premier Baron of Ireland, and enjoys the special privilege of remaining with his head covered in the presence of royalty.

Kinsale is 177 miles south-west from Dublin. The town is built in part on the side of Compass Hill, some of the streets

being so steep as to preclude the use of vehicles. It is supported chiefly by summer visitors, who resort thither in considerable numbers, and by its fisheries for which it is famous. The fishermen are esteemed most skilful both in their own calling and as pilots. There is a deep and commodious harbour. At a cable's length from the shore the depth is from 6 to 8 fathoms. At the mouth of the harbour it is 14 feet at neap-tide ebb. A fishery pier was constructed some years ago at a cost of £22,000. On the eastern shore of the harbour are, in sequence, Scilly (population, 535) and Cove (population, 208), bathing-places, and Charles Fort, now used as a military barracks. Five miles due south of Kinsale is the Old Head of Kinsale, a conspicuous landmark at sea, although it rises to only 256 feet above sea-level. The lighthouse is 100 feet high and commands splendid views of the coast. It was at Kinsale that James II. landed on March 12, 1689, in his vain attempt to recover his lost crown. Among the scenic attractions of Kinsale must be included a boating excursion up the Bandon river to Inishammon, a distance of 10 miles.

COURTMACSHERRY.

Courtmacsherry (population, 387) is a pretty fishing village, $2\frac{1}{2}$ miles south-east of Timoleague (population, 366), at the mouth of the Arigadeen river, celebrated for its Franciscan monastery, founded by Donal Glas, Prince of Carberry, in the beginning of the fourteenth century. The monastery occupies the site of St. Molaga's House, built in the seventh century, hence the name of the place Timoleague, in Celtic *Tach-Molaga*. The sea washes the walls of the monastery. The charming watering-place of Courtmacsherry has become very easy of access in consequence of the opening of the light railway from Ballinasceally—a junction upon the Cork, Bandon, and South Coast Railway, $3\frac{1}{2}$ miles from Clonakilty. Its climate resembles that of Glengariff, and is so moist and warm that delicate evergreens stand out of doors through the winter, and azaleas and rhododendrons reach a perfection rarely seen elsewhere. The Very Rev. J. O'Leary, P.P., of Clonakilty, V.F., says of it:—"On account of the wood there, one was safe in Courtmacsherry from what one suffered in other watering-places—the sweltering sun. They had in Courtmacsherry

what the poet called 'boundless contiguity of shade by the dark blue sea.'"

Passing by **Clonakilty**, a populous market town (population in 1901, 3,097), pleasantly situated at the head of Clonakilty Bay, and the terminus of one branch of the Cork, Bandon and South Coast Railway, we reach by car at a distance of 8 miles—

Rosscarbery (population, 580), a pleasantly circumstanced little town at the head of Rosscarbery Bay. It gives its name to the diocese of Ross, associated with Cork and Cloyne.

Between Rosscarbery and Skibbereen are three prettily situated villages on Glandore Harbour. These are Glandore (population, 159), on the east shore, Leap (population, 179), picturesquely located near a ravine through which the little Leap river runs into the head of Glandore inlet, and Unionhall (population, 333) on the west shore. It was at this last place that Dean Swift spent the summer of 1723 and wrote a Latin poem on the scenery of the district, entitled *Carberia Rupes*. A long bridge now spans the harbour between Unionhall and Glandore. The railway company have arranged a one day's tour from Cork to Skibbereen by rail, thence by coach to Unionhall, Glandore and Leap, and back to Skibbereen and Cork, so great is the attraction of the scenery of Glandore Harbour. The deep blue of the sea-water reminds one of the Lago di Como.

The winter climate of Glandore, and indeed of this south-west coast at large, is singularly mild. Mr. W. H. Hall saw in the garden of the Dean of Ross a flourishing palm, at least 10 feet high, which had been unprotected all the winter: and plucked flowering branches from myrtles 8 feet high. He also saw fuchsia hedges in full bloom, growing over half the cottages, which tell unmistakably of winter mildness.

CASTLETOWNSHEND.

Castletownshend (population, 947), a coastguard station on the north-west shore of the narrow inlet of the sea called Castlehaven, is much frequented in the fishing season. The small but beautiful bay runs inland for about 3 miles between hills, which are pine-clad from the water's edge to the very top. So genial is the climate that fuchsias and arbutus trees thrive along the sheltered shores of this sub-tropical haven.

The following table gives the rainfall at this station for the nine years 1892–1900 inclusive.

RAINFALL AT CASTLETOWNSHEND, Co. CORK.

Rain-gauge Diameter, 5 inches. Height above Ground, 3 feet. Height above Sea-level, 25 feet.		
Year.	Inches.	Days on which rain fell.
1892	39·28	185
1893	35·29	156
1894	37·97	177
1895	38·06	159
1896	27·55	156
1897	39·62	207
1898	30·85	179
1899	32·78	146
1900	33·37	184
Average 9 years 1892–1900	34·65	172

SKIBBEREEN.

Skibbereen (population in 1901, 3,201) is 53½ miles by rail from Cork, on the river Ilan. The Ilan Valley Railway from Dunmanway to Skibbereen, 16 miles, is worked by the Cork, Bandon, and South Coast Company, and has much benefited the town and district. The Baltimore Extension Light Railway was constructed by free grant from the Treasury, and opened for traffic on May 2, 1893. It runs along the east bank of the Ilan river to Baltimore, 8 miles. It also is worked by the Cork, Bandon, and South Coast Company. Skibbereen is a neat town, and shows few traces of the dreadful ordeal through which it passed in the disastrous famine of 1847.

BALTIMORE.

Baltimore (population, 1,032) occupies a fine position on the eastern shore of Baltimore Bay, 8 miles south-west of Skibbereen and 5½ miles north-east of Cape Clear. The bay is sheltered by Clear Island and by Sherkin Island, each of which is about 3 miles long. The well-known Fastnet Rock, with its lighthouse towering 148 feet above high-water level, lies 3½ miles west by south of

Cape Clear. Baltimore has now a flourishing fishery, thanks to the establishment of an Industrial Fishery School by the late Father Davis, P.P., who died in 1892, nobly aided by the Baroness Burdett-Coutts. Like all the neighbouring districts, Baltimore enjoys a wonderfully mild, if an unsettled, windy and rainy climate.

A tramway or light railway runs westward from Skibbereen by the northern shores of Roaringwater Bay past Ballydehob (10 miles), near which there are copper mines, to Skull or Schull (population, 490), (15 miles), a village on a fiord off Roaringwater Bay and at the foot of Mount Gabriel, 1,339 feet in height. Eleven miles further on towards the south-west and in the direction of Mizen Head, is the isolated village of **Crookhaven** (population, 588). The "Haven" is a safe one, completely protected from the swell of the open Atlantic by a long peninsula running out towards east-north-east, and terminating in a small promontory called Street Head. The neighbouring promontories of Mizen Head and Brow Head share the honour of being the most southerly points of the mainland of Ireland.

BANTRY.

Bantry (population in 1891, 2921) is beautifully situated opposite Whiddy Island, near the north-eastern extremity of the magnificent fiord to which the town gives the name of Bantry Bay, 21 miles long and 4 miles wide. The word Bantry means "White Strand," and refers to the colour of the sand in the vicinity. As the prevalent rain-bearing south-westerly winds sweep in from the Atlantic and impinge on the high mountains which rise north-east of Bantry, the place has a cloudy, damp, and rainy climate, its one drawback. The Cork, Bandon, and South Coast Railway has here its western terminus at a distance of $57\frac{3}{4}$ miles from Cork, and the descent from Durrus station, $5\frac{3}{4}$ miles distant, to the station at Bantry, is a marvellous piece of engineering. From this steep incline lovely views of Bantry Bay are obtained. The line was opened in 1893, and it has made the journey to Glengariff very easy for an invalid. The Bantry Woollen Mills testify to the happy revival of an Irish industry which flourished many years ago. To the south-west of the town is Bantry House, the residence of the widowed Countess of Bantry, embowered in a well-wooded

demesne, and commanding enchanting views of the noble bay and its mountainous western shores. Whiddy Island is fortified by three redoubts. So also is Bear Island, off Castletown Bearhaven, further down the bay and on its western side. In 1689 and again in 1796, French vessels of war made their way into the magnificent roadstead of Bantry Bay. About 14 miles due west of Bantry rises the imposing mountain called Hungry Hill (2,251 feet), the highest point of the Caha mountains. From its eastern precipices a great cataract falls in a series of almost continuous cascades into Adrigole creek. The stream takes its rise in three lakelets or tarns, respectively 1,360, 1,126, and 1,011 feet above sea-level. After heavy rains this cataract, 700 feet in height, may be seen even from Bantry, some 12 miles away.

There is a drive of 11 miles from the town of Bantry to Glengarriff. It is for the most part along the shores of the bay. Although charming in fine weather, this drive is tame in comparison with the magnificent drive from Glengarriff to Kenmare. The road, which is a wonderful piece of engineering, was constructed by Nimmo. It ascends to more than 1,000 feet above the sea, at which elevation it passes through a tunnel under Turner's Rock (1,393 feet). From this height one looks upon Bantry Bay, with its countless islands, its wooded shores, and its overhanging mountains. At the summit of this pass is the boundary between the counties of Cork and Kerry.

GLENGARRIFF.

Glengarriff, strictly speaking, is a small hamlet near the lower end of the beautiful glen, through which the river of the same name flows from its source in a number of tarns on the eastern side of the Eagle's Nest, 2,005 feet high, into a sheltered creek at the extreme northern point of Bantry Bay. The name means "Rugged Glen," but its rocky slopes have been beautified and softened by a dense growth of forest trees and underwood clothed in perennial green.

As it is commonly understood at the present day, Glengarriff is a popular health resort. Accommodation for visitors is provided in Eccles' Hotel at the water's edge, at the Belle Vue Hotel on

higher ground, and at Roche's Royal Hotel, which is 1½ miles distant on very high ground, so commanding an exquisite view of the surrounding district.

Glengarriff is no new discovery. So long ago as 1845, the late William Makepeace Thackeray wrote as follows in his *Irish Sketch Book*:—"What sends picturesque tourists to the Rhine and Saxon Switzerland? Within 5 miles of the pretty inn of Glengarriff, there is a country of the magnificence of which no pen can give an idea. I would like to be a great Prince, and bring a train of painters over to make, if they could, and according to their several capabilities, a set of pictures of the place. Were such a bay lying upon English shores, it would be a world's wonder. Perhaps, if it were on the Mediterranean or the Baltic, English travellers would flock to it by hundreds. Why not come and see it in Ireland?"

Such is Glengarriff. It is a matter for regret that there is no meteorological station in the neighbourhood. The climate, however, is like that of the other fiords of Kerry—mild, rainy, and breezy. The annual rainfall is about 50 inches on some 230 days. But the ground dries quickly owing to its hilly character, and above all the bulk of the rain falls in the late summer, throughout the autumn, and in the early winter. At the season when Glengarriff is most needed as a health resort—namely, spring—the climate is generally delightful. There is at that time a moderate rainfall, the sky is clear, and the wind, although easterly, is deprived of all its harshness by passing over a considerable extent of water surface. In spring both the Riviera and the health resorts along the south coast of England are liable to keen and searching easterly winds, and further the rapid fall of temperature at sunset owing to the dryness of the air is prejudicial to health. These drawbacks are happily wanting in the case of Glengarriff. The great feature in the climate is the equable temperature. Extremes of heat and cold are unknown, and the mean temperature of the warmest and coldest months does not diverge more than 15° or thereabouts.

A glance at the map will show how sheltered Glengarriff is. To the south-east, at a distance of 2 miles, there is an elevation of 400 feet. Due east Cobduff or Cobdhuv Mountain attains 1,244 feet at the back of Glengarriff Castle, from which there is a fine view. Five miles north-east, Knockboy reaches 2,321 feet. On

the south-west, west and north-west, the Caha range, rising to 2,000 feet and upwards, offers a barrier to the strong winds from those quarters. The Sugar Loaf Mountain (1,887 feet) at 5, and Shrone Hill (919 feet) at $1\frac{1}{2}$ miles, lie due south-west. Only to the south wind is Glengarriff Harbour exposed, and even in this case Garinish Island shelters the shore near the Eccles Hotel.

According to Dr. Edgar Flinn,¹ its mild and equable climate renders Glengarriff a most desirable residence for sufferers from bronchial affections, asthma and consumption. In the last-named disease an increased appetite, a disappearance of night perspiration and fever, and a general constitutional improvement often testify to the beneficial effects of a sojourn in this calm retreat. The same authority states that rheumatic and gouty subjects requiring a high temperature and a minimum of temperature range, derive considerable relief from a visit to Glengarriff in the winter months.

Dr. John Adderley, Medical Officer of the Glengarriff Dispensary District and local Medical Officer of Health, has been good enough to give me the fullest information as to the health of his district. He writes (under date August 13, 1899):—

“The death-rate is very low, the people being healthy and not subject to either endemic or epidemic disease of any kind. We are generally free from scarlet fever, measles, etc., unless by importation, when such diseases are prevalent in the town of Bantry and around us. The district is, in fact, remarkably healthy, and people live to a good old age. I registered a man's death last quarter, at the ripe age of 105 years. A woman also died at 100 years. There was not a single case of fever in the past year and a half, although it is very difficult to get the poor people to keep their dwellings and surroundings in a proper sanitary condition. The Sanitary Authority have recently erected a water-tank and supply-pipes in the village of Glengarriff, together with a public sewer for drainage, thereby improving the health of the locality.

“Of those visitors suffering from pulmonary disease, who have come to seek benefit from the climate, I can only say that some have benefited by the change, and others returned home to die. The climate in the neighbourhood of the Eccles Hotel is considered

¹ *Transactions Royal Academy of Medicine in Ireland*, 1888, vol. vi. p. 452.

to be too moist and relaxing. The Belle Vue Hotel is on higher and healthier ground, and Roche's Royal Hotel is better suited for invalids, but neither are used at present to any extent as winter resorts for the sick.

"Anæmia and debility are rather prevalent, although the water supply of the district is fairly impregnated with iron. Debility can usually be traced to an insufficiency of wholesome food. Scrofula and tuberculous diseases may be put down to the same predisposing causes. Diseases of the respiratory organs occur but seldom, as the inhabitants reside chiefly in the open air, and use their homes only as a shelter during the night, their occupation being for the most part in the fields. Renal diseases are very rare. Rheumatism is very prevalent, from the people being out in all weathers with their clothes often soaking with rain. Skin diseases are most prevalent from want of cleanliness and the great antipathy to soap-and-water which exists, 'dry scurvy' being a very common complaint in children. I have seen very little eczema. I have not seen a single case of diphtheria since I came into the district. Endemic sore throat is unknown. Tonsillitis is prevalent, and a few cases of ulcerated sore throat are seen occasionally. On the whole, I can affirm that my district is a very healthy one.

(Signed) "JOHN ADDERLEY, M.D."

COUNTY KERRY.

"The south-western part of Kerry is now well known as the most beautiful tract in the British Isles. The mountains, the glens, the capes stretching far into the Atlantic, the crags on which the eagles build, the rivulets brawling down rocky passes, the lakes overhung by groves in which the wild deer find covert, attract every summer crowds of wanderers sated with the business and the pleasures of great cities. The beauties of that country are indeed too often hidden in the mist and rain which the west wind brings up from a boundless ocean. But, on the rare days when the sun shines out in all his glory, the landscape has a freshness and a warmth of colouring seldom found in our latitude. The myrtle loves the soil. The arbutus thrives better than even on the sunny shore of Calabria. The turf is of livelier hue than

elsewhere: the hills glow with a richer purple: the varnish of the holly and ivy is more glossy; and berries of a brighter red peep through foliage of a brighter green. But during the greater part of the seventeenth century, this paradise was as little known to the civilized world as Spitzbergen or Greenland." Such are the glowing terms in which that great master of English, Lord Macaulay, describes the fiords, lakes, and mountains of the "kingdom of Kerry."

In a delightful little book but lately published, and well named *The Sunny Side of Ireland*, the author, Mr. John O'Mahony, thus describes the beautiful country the traveller passes through over the system of the Great Southern and Western Railway:—

"A beautiful country it truly is, be it approached from Athlone, its north-western gate, by the Shannon, where

‘In the quiet watered land, the land of roses,
Stands Saint Keiran’s city fair,’

or from its south-western side, in the kingdom of Kerry, where the ocean leans against the mountains, and the storm-swept peak of Skellig Michael makes the most westerly citadel of Christ in the Old World! Everywhere within its broad borders, swift-rushing rivers, mirror-like lakes, and mountains tiaraed in the skies, delight the vision and gladden the heart."

The county of Kerry is 60 miles in length from north to south, and 58 miles in breadth from west to east. It has a coast-line of 220 miles, fringed with islands and deeply indented by three great fiords, Kenmare River and Dingle and Tralee Bays. Bantry Bay, a fourth similar fiord, is in the co. Cork: and the vast estuary of the Shannon forms the northern boundary of the county. Between the fiords long peninsulas jut out into the ocean. These are occupied by branches of the remarkable mountain system which, stretching westward from the county of Waterford, traverses the whole of the south of Ireland, playing the part of a gigantic barricade against the inroads of the Atlantic. This mountain system consists largely of Old Red Sandstone (Devonian) forming the ridges, or anticlinals, which reach their summit-level in Carran-tual (3,414 feet) and the range of the so-called Macgillicuddy's Reeks. Carboniferous shale and carboniferous limestone occur in the synclinals, which have weathered out as

valleys, through which most of the streams of the south of Ireland run east and west. "Where the coast," writes Prof. Grenville Cole, F.G.S., in an admirable article on the "Structure of Ireland,"¹ "shows the structure of fiords or 'rias,' the sea has entered along the troughs, along the basins of the carboniferous limestone; and the pale water is bounded by steep slopes of sandstone, grey and brown and purple, the actual flanks of the anticlinals, in which the Devonian rocks have been exposed. Here and there, in the larger of these massive anticlines, the twisted core of Ordovician shales and sandstones is also bared to the light of day, while mere patches of the crest of the great Devonian arch remain upon the summit of the ridge. In the central districts of Kerry the soil consists of a rich loam, and is productive in grain-crops and in pasture."

KENMARE.

Kenmare (population, 1,189) stands near the head of the so-called Kenmare River, a magnificent fiord 30 miles in length from the open sea to the estuary of the river Roughty. The town is a quarter of a mile from the northern shore of the estuary. The name means the "Head of the Sea" (Celtic, *Ceann*, head; *mar*, sea). It is $197\frac{3}{4}$ miles from Dublin, a branch of the Great Southern and Western Railway from Headford Junction having been opened in 1893. Another means of approach is by road from Glengarriff, a distance of 18 miles across the Caha mountains, descending from the summit-level of the tunnel under Turner's Rock through the valley of the Sheen river. To reach Kenmare the road is carried across a suspension bridge, 410 feet in length, spanning the Kenmare River. This was the first bridge of the kind in Ireland, and was begun in 1838. The views which this road command in fine weather throughout its entire length are surpassingly beautiful and even sublime.

Kenmare was founded by Sir William Petty, ancestor of the Marquis of Lansdowne, in the year 1670. Forty-two houses were erected, and the population of this English colony in the far west numbered 180 souls. Lord Macaulay writes:—"The little town which he founded, named from the bay of Kenmare, stood at the head of that bay, under a mountain ridge, on the

¹ *Knowledge*, April 1898.

summit of which travellers now stop to gaze upon the loveliest of the lakes of Killarney. . . . The land round the town was well cultivated. The cattle were numerous. . . . The supply of herrings, pilchards, mackerel, and salmon was plentiful, and would have been still more plentiful had not the beach been, in the finest part of the year, covered by multitudes of seals, which preyed on the fish of the bay. . . . An attempt was made with great success to set up ironworks. . . . The neighbourhood of Kenmare was then richly wooded: and Petty found it a gainful speculation to send ore thither. The lovers of the picturesque still regret the woods of oak and arbutus which were cut down to feed his furnaces." This quotation from the great historian does but justice to the natural advantages of Kenmare, and now an active art industry in lace-making exists in connection with the Convent of Poor Clares, founded in 1861 by the Abbess O'Hagan. Other art industries taught in this institution are Celtic embroidery, illuminating, wood-carving and leather work.

In summer Kenmare is resorted to as a bathing-place, although its distance from the open sea perhaps renders the water less bracing than along the coast. The hotel accommodation is excellent. The Southern Hotels Company some years ago built a first-class modern hotel on a charming site overlooking the river and surrounded with beautiful grounds. In the town is the older Lansdowne Arms Hotel, at which the coaches rendezvous. Kenmare may be considered the key to the beautiful scenery of Kerry. From it, as a starting-point, the visitor may drive to Killarney (20 miles), to Glengarriff (18 miles), to Castletown Bearhaven, by Kilmakilloge Harbour (29 miles) to Sneem, by Parknasilla (16 miles), and to Waterville (38 miles) *en route* to Valentia Harbour (47 miles), and Cahirciveen (50 miles). To most of these places well-appointed public cars and *char-à-bancs* run at fixed times throughout the summer season. Kenmare is also a great fishing centre—for salmon and trout especially.

A great fragment of rock, weighing more than 100 tons, lies on a heather-clad slope near the river at Kenmare. It is called the "Cloghvorra Stone." Sir Robert Ball, F.R.S., in his work on *The Cause of an Ice Age*, gives an account of this monumental rock, on which is written the epitaph of a glacier.

PARKNASILLA.

Parknasilla (14 miles by road from Kenmare) is not a town or even a village, but a romantic health resort of recent creation on the northern shore of Kenmare River, 2 miles south-east of the village of Sneem. The drive from Kenmare is most beautiful, affording splendid views of the opposite or southern shore of the fiord, with the ranges of the Caha mountains and Slieve Miskish. Eight miles from Kenmare the river Blackwater is crossed by a bridge, 60 feet above the stream, which rushes into the sea close by, down a densely-wooded, deep and rocky ravine. The Blackwater, which is essentially a mountain torrent even to its mouth, rises in Lough Brin, a tarn in a deep amphitheatre called "The Pocket." The cliffs on the south-west of the Pocket are formed by Beoun Mountain (2,468 feet), and on the north-east by Mulla-ghanattin (2,539 feet). These heights form the watershed between the Blackwater on the south and Caragh river on the north.

Parknasilla is a sheltered bay, wooded down to the water's edge not only with forest trees—chiefly beech, oak and fir—but with an undergrowth of rare luxuriance, in which the arbutus and myrtle, the oleander and the rhododendron vie in beauty with fuchsias and beds of daffodils. The waters of the bay are studded with islets, which effectually protect the coast. Of these perhaps the most beautiful is Garinish, the property of the Earl of Dunraven. To the north of the bay is Rossdohan Island, opposite Derryquin Castle.

Some years ago the Southern Hotels Company acquired the Parknasilla property, extending to 100 acres, and converted Bishop Graves's house into a hotel. More recently the Company built a first-class modern hotel nearer the sea, and on ground sufficiently high to afford a beautiful view. Attached to the hotel are Turkish and hot and cold sea-water baths. Both houses are admirably suited for either the summer tourist or the invalid.

In an article on Parknasilla as a health resort, which appeared in the *Dublin Journal of Medical Science*, May 1896, Dr. D. Edgar Flinn, D.P.H., wrote of this favoured spot as follows:—

"Mountain protection is of supreme importance in the choice of a health resort, more especially in the winter and spring seasons

of the year. In this regard Parknasilla is exceptionally favoured, a mountainous range closely guarding and protecting it from the northerly and easterly winds. The combination of mountain, wood, and water gives a special charm to this locality; and a convincing evidence of the mildness of the winter and early spring here is the forward character of the vegetation, the early budding of the trees, shrubs and flowers—all bearing testimony to the mildness of the climate. Temperature rapidly tells its tale on the vegetable world, and there can be no more reassuring proof of the equable and balmy character of the climate of a district, than the early growth of flowering shrubs, plants, and table produce. The position of this favoured and sheltered sea inlet upon the isothermal map shows it to have a mean annual temperature of 52°, being similar in this regard to its neighbour, Glengarriff, and registering a higher mean temperature than Ventnor or Torquay. The mildness of the climate in the earlier spring months is of such a character that exercise can be freely partaken of in the open air daily, without risk of chill: and this to the invalid is of paramount importance. No record has, as yet, been regularly taken of the daily sunshine, or of the rainfall, but so far as could be ascertained, the rainfall does not appear to be excessive. To sufferers from chronic or recurrent affections of the respiratory organs, Parknasilla in the winter and early spring months would appear to be indicated as a most desirable place of residence. I have had the advantage of two recent visits to this district, and feel convinced that, when it becomes better known, Parknasilla will prove a veritable haven of health and rest to the chronic invalid and the convalescent, as well as a delightful retreat to the busy man of the 'world's mart,' who may need a temporary repose from the worries and cares of daily life."

The Southern Hotels are now the property of, and are managed by, the Great Southern and Western Railway Company of Ireland.

The drive by coach from Parknasilla to Waterville, near Lough Currane, is delightful in fine weather. The scenery of the Kenmare River, as this great fiord opens into the Atlantic Ocean, is rarely equalled, never surpassed. The eye is literally feasted with an ever-changing panorama of hill and valley, woodland, moor, sea, and island. After passing the village or town of Sneem the road bends inland, affording fine views of Coomcallee (2,134 feet

high). Then crossing a wild upland district for some miles, it descends once more almost to sea-level and skirts the coast. At Castle Cove and West Cove there are beautiful bathing-strands. On the hill-side, 2 miles from the road at West Cove, may be seen the remarkable building called the Staigue Fort, which is at least 2,000 years old. The village of Cahirdaniel stands on the site of a Danish fort, which may still be traced. Derrynane, the residence of Daniel O'Connell, the "Liberator," and its ruined Abbey are next passed, and beautiful views of Scariff and Deenish Islands and Lamb's Head are obtained. The road then rises to a height of about 600 feet to pass through a gap in the mountains overhanging Ballinskelligs Bay on its eastern side. The gap is called Coomakista Pass. A rapid descent of 5 miles takes the traveller to Waterville.

WATERVILLE.

Waterville, a village standing on the narrow neck of land which separates the sea from Lough Currane, is yearly increasing in size and in reputation as a bathing-place and health resort. It possesses many attractions. The fine scenery of Ballinskelligs Bay, Lough Currane, and the mountains, good sea-bathing, the fine strand and golf-links (9-hole course) combine to make the place popular. Lastly, there is a first-rate modern hotel on the shore of Lough Currane, famous for its trout-fishing, which is managed by the Great Southern and Western Railway Company. The Butler Arms and Bay View Hotels are in the village itself. Just outside Waterville are the extensive offices of the Trans-Atlantic Commercial Cable Company (Mackay-Bennett system). The cable-station is at Ballinskelligs on the other side of the bay, which ends at Bolus Head, a spur of Bolus Mountain which rises to 1,350 feet above the sea. Off the western side of Ballinskelligs Bay are the Lemon Rock (5 miles), the Little Skellig (7 miles), and the Great Skellig (8½ miles). The last-named is a stupendous mass of rock, towering to a height of 704 feet. The island is about half-a-mile long and a quarter of a mile wide. It is dedicated to St. Michael, and was for centuries a place of penance. St. Michael's Rocks in Normandy and Cornwall "sink into utter insignificance beside the wild grandeur of the Skellig."

A lighthouse stands 130 feet above high water, yet in a gale the waves send sheets of foam to this height, and the cliffs are carved into many fantastic shapes by the almost ceaseless action of the ocean.

The least interesting part of the coach-drive of $46\frac{1}{2}$ miles from Kenmare to Cahirciveen is the stage between Waterville and Cahirciveen, but this is likely soon to be bridged over by an extension of the Great Southern and Western Railway. The Cahirciveen branch of this great system runs down to Valentia Harbour, whence the traveller crosses to **Valentia Island** by ferry-boat. The views of and from Valentia are strikingly beautiful. In order to see everything to advantage, a car should be chartered at Knightstown, the chief town in the island. There is much of interest to be seen. Glenleam or Glanleam, the demesne of Sir Maurice Fitzgerald, the Knight of Kerry, the wonderful slate-quarries and the caves which have been formed therein, Bray Head and its beetling cliffs, 792 feet high, overhanging the majestic Atlantic, and the beautifully-named village of Clynacartan on the southern sound—are all worth a visit. The offices of the Trans-Atlantic Telegraph Company at Knightstown should also be inspected.

VALENTIA ISLAND.

Dr. Patrick Letters, D.P.H., Medical Officer of the Anglo-American Telegraph Company, who resides at Knightstown, Valentia Island, co. Kerry, has kindly made the following Report on the island at my request:—

“**Valentia Island**, off the south-west coast of Kerry, is almost 7 miles long, and has an average breadth of about 2 miles. At one point only a breadth of $2\frac{1}{3}$ miles is reached. The sea-channel separating it from the mainland is quite 10 miles in length, and of irregular contour. At the narrowest point—opposite the village of Portmagee—the ferry is only a good furlong across. The widest point is opposite the buildings of the Anglo-American Cable Co., south of Knightstown, where it is $1\frac{1}{2}$ miles across to the mainland. The ferry at Knightstown, by which railway-travellers cross, is a little under half-a-mile in breadth. In the $4\frac{1}{2}$ miles’ stretch between the widest and narrowest points, the channel has an average width of more than half-a-mile.

“Generally speaking, the surface is hilly, the higher ground being towards the Atlantic side of the island. At both extremities of the island, whose long axis runs in an east-north-east and west-south-west direction, the elevation reaches between 800 and 900 feet. High ground stretches between these two points, which sinks however, near the centre, to under 200 feet. From this elevated ridge, the surface slopes gradually to sea-level on the side facing the mainland, but the Atlantic coast, all round the north and west sides of the island, is formed of high and precipitous cliffs. Valentia is not very well sheltered against any wind. The higher ground to the north and west affords some slight protection against winds blowing from these points to the opposite low-lying parts. The prevailing south-westerly winds have free play up the channel, inside the basin formed by the elevated part of the island and a range of hills on the mainland, distant about 3 miles, and about 1,000 feet high. Occupying the centre of the northern approach to Valentia Harbour from the ocean is the irregularly-shaped small island of Beginish. This is almost cut in two by a narrow isthmus, and is a favourite summer resort for picnics. On account of its fine sandy beach, Beginish is also frequented for sea-bathing.

“Geologically, Valentia forms part of the great Old Red Sandstone formation, which stretches across Kerry and Cork into Waterford county. The famous Valentia slates, which in bygone days were extensively quarried and shipped to all parts of the world, belong to this formation. Over almost the whole island the surface is composed of bog of different thicknesses. In the western parts this affords fuel for the inhabitants, but elsewhere it is a very thin layer, usually from 12 to 18 inches only. Beneath this is found either yellow clay or rubble. At the telegraph-station, the surface bog is 1 foot thick, beneath which is a layer of 6 feet of rubble. Underneath this is found 3 feet of bluish clay, and then the solid rock, which is thus about 10 feet from the surface. It is supposed that the rock is of very considerable thickness. It is exceedingly hard, as the tools of workmen at present engaged in water-boring operations show. At a depth of 67 feet from the surface, an abundant supply of water has been found.

“Generally speaking, the surface soil is not very retentive of moisture where there is any slope. In some of the low-lying spots

in the western part of the island, the moisture of soil is excessive, and it is only in very dry seasons that crops are satisfactory. Over the greater part of Valentia, however, there is a good fall for drainage, and fields and roads dry rapidly after the heaviest showers.

The general absence of trees in Valentia does not accord very well with the ancient name of the island—*Dairbhre*—which signifies an oak forest. The Irish-speaking natives still call the island Dairery. Remains of trees are occasionally dug up where the layer of bog is deep, but it is not easy to understand how trees which send their roots to any depth could flourish in the barren clay subsoil which commonly abounds. The general bareness of the island in respect of trees is greatly relieved by the woods around Glanleam, the seat of the Knight of Kerry. These give to the north end of the island, overlooking the harbour, an aspect of great natural beauty and freshness. If trees were planted judiciously around dwellings throughout the island, they would afford considerable protection from the winds, to which Valentia is, from its geographical position, exposed. They would also be of distinct hygienic value by removing excessive moisture from the soil, and by purifying both soil and air by their roots and green leaves.

A few facts in reference to the phenology of Valentia may be worth mentioning. For them I am indebted to Mrs. Delap, wife of the Church of Ireland rector of the parish. The Arum Lily, *Calla Æthiopica*, thrives perfectly well in the open air all the winter, blooming continuously and very profusely from January (in mild years) all through the summer, a good clump often carrying thirty to forty splendid blooms. The *Mandevilla Suavolens*, considered essentially a warm greenhouse plant elsewhere, here grows and blooms outside in a sheltered position, and also seeded freely out of doors in one warm summer. A heliotrope has stood out the winters for many years at Glanleam, and was in bloom in November. The *Fuchsia Riccartonii* is in Valentia almost a weed, growing any and everywhere, forming hedges which are so luxuriant as to be almost irrepressible, and even making its way through stone walls. This does not die down all through the winter, but remains full of sap, and at the first mild day bursts into leaf and blooms, often during the middle of winter. In shrubs, we have the *Azalea Indica* and *Benthamia Fragifera*, both bloom-

ing freely. An Indian shrub, *Drinys Winteri*, has been at Glanleam in full and luxuriant blossom early in April, and fruits abundantly every year. Some South American trees also flourish at Glanleam in the open. Wild flowers are in great profusion, and several delicate species of ferns are luxuriant beyond description in the depth of winter.

"Birds of passage visit Valentia in season. The cuckoo is heard at the end of April; the maybird (whimbrel) comes in May, and remains till July. Gannets breed largely in these waters.

"It is characteristic of the mildness of Valentia winters that cattle and sheep may remain out all through the winter.

"Owing to the poor quality of the soil, herbage is deficient in nutritive qualities, and cattle as a consequence are small. It is often observed, however, that animals fatten and thrive during the winter, when they do not do so in the summer. This is supposed to be due to the immature and bad quality of the grass in the summer, which is fully ripe in the winter, and is analogous to the better nutritious properties of roots for cattle-feeding when these are preserved for some time before consumption, their digestibility being increased.

"The effects of ocean currents upon the climate of Valentia are obvious. The island is, from the geographical position, exposed to the full influence of the Gulf Stream. The climate is, therefore, typically an insular one. The remarks which follow in reference to meteorological factors are deduced from tables compiled for a period of twenty-three years at the Observatory in Valentia Island, before its transference to the mainland a few years ago. From the table giving mean monthly and annual temperature during the period 1869-1891, it appears that the mean temperature for the whole period was $51^{\circ}0$. For the lustrum 1871-75 half a degree more ($51^{\circ}5$) is recorded. The variability from year to year in this factor of mean annual temperature is very small—usually only a few decimal points of a degree—but one year (1869) recorded $52^{\circ}3$, and another (1879) only $49^{\circ}2$. Both years are, however, distinctly exceptional, as no other year of the twenty-three actually reached 52° or fell below $50^{\circ}1$.

"The highest mean monthly temperature for the whole period, $59^{\circ}2$, is reached in August, and the lowest, $44^{\circ}9$, in December. January gives $45^{\circ}2$, February $45^{\circ}3$, and March $45^{\circ}4$. These

figures show a remarkable uniformity of temperature during the four coldest months of the year. The mean temperature for July is $58^{\circ}7$, while June and September each show $56^{\circ}6$. Here again, during the warmest months, the changes from month to month are also very small. Of the remaining months, April shows a mean temperature of $48^{\circ}5$, May of $52^{\circ}1$, October of $51^{\circ}7$, and November of $47^{\circ}8$. During the season of increasing temperatures the largest increment of heat ($4^{\circ}5$) is found between May and June. When temperature is falling, the greatest decrease ($4^{\circ}9$) is shown from September to October, after which the fall to December is very steady. Some of the possibilities of high mean temperature in winter are worth mentioning—thus $49^{\circ}0$ was recorded for December 1873, $49^{\circ}2$ in January 1875, $48^{\circ}7$ in February 1869, and $48^{\circ}5$ in March 1880. Similarly, to show cool summer temperatures, $55^{\circ}5$ was recorded in July 1879, and $57^{\circ}0$ in August 1881. The warmest month in the twenty-three years was August 1880, when the mean temperature stood at $62^{\circ}8$. The coldest month during the same long period was January 1881, with a mean temperature of $38^{\circ}6$ only.

“ If we now examine the table giving Mean *Hourly* Values for air temperature in each month during twenty years, 1871–1890, it is found that the highest temperatures occur at 3 p.m. from February to September, and at 2 p.m. from October to January. The lowest temperatures are found at 4 a.m. in June and July; at 5 a.m. in May; at 6 a.m. in February, March, April, August, September and October; and at 8 a.m. in November, December and January. As the extent of range of hourly temperatures has an important bearing upon the question of ventilation by open windows, and especially of this means of natural ventilation of bedrooms during the sleeping hours, this table appears to be one of much practical interest. Taking the mean figures for the twelve months of the year collectively, the greatest heat at 3 p.m. is $53^{\circ}70$, and the least at 5 a.m. $48^{\circ}94$, thus showing a range of $4^{\circ}7$ only. Taking up the months one by one, the range in January is $2^{\circ}0$; in February, $3^{\circ}2$; in March, $5^{\circ}1$; April, $6^{\circ}6$; May, $7^{\circ}4$; June, $7^{\circ}1$; July, $6^{\circ}1$; August, $6^{\circ}2$; September, $5^{\circ}4$; October, $4^{\circ}1$; November, $2^{\circ}9$; December, $2^{\circ}4$.

“ As the problem of bedroom ventilation is in most localities considered to be more difficult of solution in winter than in

summer, the very small range between the warmest and coldest hours throughout December, January and February, as well as November, warrants the conclusion that temperature alone is *not* the difficulty in Valentia. The force and velocity of the entering current of air is a factor not to be overlooked; and it seems more necessary to have arrangements for breaking the force of the entering air than for raising its temperature. Practically, widely-opened windows can be tolerated during the summer nights in Valentia when only light breezes blow, but there are very few occasions even in winter when windows must be completely shut. This is my personal experience, but I find great difficulty in getting people to abandon their time-honoured custom of sleeping with windows entirely closed.

"The next table calling for remark is that giving the Mean Monthly and Annual *Maximum* Temperature during the period 1869–1891. The mean annual maximum temperature for the whole period was $55^{\circ}3$. August and December are again the highest and lowest of the months, the former showing $64^{\circ}2$ and the latter $48^{\circ}3$. The highest mean maximum temperature recorded was $69^{\circ}8$ in August 1880. Taking the four winter months again for the whole period, the mean maximum temperature for January is found to be $48^{\circ}4$; for February, $48^{\circ}7$; and for March, $49^{\circ}7$. The maximum temperatures in winter are thus seen to exhibit the same character of unchangeableness, noticed also in the case of the mean temperatures.

"Turning now to the table of Mean Monthly and Annual *Minimum* Temperature, it is found that $46^{\circ}5$ is the mean of the entire period of twenty-three years. August shows $54^{\circ}6$ and December $40^{\circ}7$. It is noteworthy that March records almost as low a figure as December ($40^{\circ}8$), that January gives $41^{\circ}2$, and February $41^{\circ}4$. Here again there is marked uniformity of minimum temperature throughout the winter.

"The next table is that showing *Extreme Maximum* Temperatures for each month and year from 1869 to 1891. The highest of these extreme figures for the whole period was $82^{\circ}3$, which occurred in August 1869. In only one other August—that of 1874—was an extreme temperature of 80° recorded. In July 1878 a temperature of $80^{\circ}1$ was recorded, and in June 1887 the extreme maximum temperature rose to $80^{\circ}6$. These few instances of high

temperature however, only emphasize the infrequency of such temperatures in Valentia.

"Turning to the table for *Extreme Minimum* Temperatures for the months and years of the same period, 1869 to 1891, the lowest recorded (24·6) was in January 1881. December 1886 gave 26·8; February 1873, 25·2; March 1891, 28·7. The lowest recorded temperature for any August was 42·9, and for any July, 44·8. The number of times the minimum was below the freezing-point was comparatively small. This occurred in January in 13 years, in February in 8, in March in 12, in April in 1, in November in 4, and in December in 14 years.

"Vapour tension results are recorded in a table giving Mean Monthly and Annual values for the same twenty-three years.

"The mean for the whole period was 312 inch. August records the highest figure, 415 inch, and March the lowest, 245 inch. December shows 249; January 253; and February 254 inch.

"Relative humidity is also given for the same period in a table showing Mean Monthly and Annual values. The mean for the whole period of twenty-three years was 83 per cent. Relative humidity is highest in January and February, each month showing 85 per cent., and lowest in May, which gives 79 per cent.

"The mean annual rainfall at Valentia amounts to 57·7 inches. In 1877, the fall (68·6 inches) was the heaviest in the period. In 1887, only 43·7 inches fell. January is found to be the wettest month, its average being 6·5 inches. May gives the least rain of any month, its average being only 3·3 inches. June and April are the next driest months, their falls being respectively 3·6 and 3·8 inches. A fall of 10 inches in one month is so rare that it is interesting to note that this occurred in four months only within the twenty-three years. These very wet months were February 1883, March 1884, October 1891, and November 1877.

"It is equally rare to find a month with less than 1 inch of rainfall, but there are also four instances of this recorded in the period dealt with. These remarkably dry months were February 1891, May 1876, June 1870, and November 1879. Next to January, the wettest months in an ordinary year in Valentia are December, 6 inches; October, 5·8; November, 5·5; February, 5·1. Intermediate between the wet and dry months come August, 4·8 inches; September, 4·7; March and July, each 4·1 inches.

"The average number of days of rain in the year (limit 0·005 inch) is 248. In the wettest year, above referred to, the rain fell on 288 days, and in the driest on 194 days.

"The number of days in each month on which some rain falls has been recorded during the interval 1869 to 1891, and means have been calculated for the separate months. In January and December some rain falls on 23 days, in October and November on 22 days, in February, July and August on 21 days, in March and September on 20 days, in April and May on 18 days, and in June on 17 days. Since these records were taken, my impression is that we have had some exceptionally dry Aprils and Mays, during which water supplies became very scanty.

"Snow and hail are rare phenomena in Valentia. When hail falls it is in winter usually, and is soft, and not connected with thunder. This phenomenon in twenty-two years occurred 15 times in January, 14 times in November, 11 times in February and September, 12 times in August and October, 7 times in March, June, July and December, and only 4 times in April and May. Fog is a very rare phenomenon in Valentia. I can only recall one dense fog in six years' residence in the island, which passed away in a couple of hours.

"Sunshine records for ten years are available, and are given in percentages of the possible amounts. Average figures show the month of May to give over 43 per cent., but April and June follow close with 41 and 40 per cent. respectively. December gives less sunshine than any other month—19 per cent., which is equivalent to about 46½ hours. In January 56 hours of sunshine may be expected; in February, 73; in March, 132; in April, 169; in May, 209; in June, 198; in July, 158; in August, 161; in September, 122; in October, 98; in November, 60.

"I have no available tables of the force, direction, or velocity of the wind, but it is exceedingly seldom that the air is perfectly still at Valentia. During the winter months gales are rather frequent, and occasionally violent. In summer gentle refreshing breezes prevail. Barometrical pressure reaches its maximum in June 29·973, and its minimum, 29·850, in April, the total amplitude being therefore 0·123 inch. The absolute extremes of pressure show a considerable range, from 30·940 inches on January 14, 1891, to

28·070 inches on January 15, 1871, giving a difference of 2·870 inches. The total range of the barometer exceeds 2 inches in all the months from September to March inclusive, and in the remaining five months—April to August—it exceeds $1\frac{1}{2}$ inches with the exception of July, in which it records 1·425 inches. This is for the whole period of twenty-three years.

“As July gives the lowest range, January gives the highest, 2·870 inches. November comes second with 2·462 inches, and March third with 2·420 inches. The mercury has never fallen below 29 inches in either June or July during the whole period of twenty-three years.”

On the following page a table is given showing the meteorological data at Valentia in abstract during the twenty-five years ending with 1895.

“*Drainage* in the island of Valentia with few exceptions is not in accordance with modern ideas. Two rudely-constructed and squarely-built sewers carry the sewage of the village of Knightstown to the sea, as well as storm-water. Many of the smaller houses have no drainage whatever. During the autumn months, when fish-curing is carried on in the buildings of the old slate yard, the filthy water in which the fish have been washed, with much of the offal, is carried to the sea through the old-fashioned sewers referred to, and a decided nuisance is created, which is masked by the sprinkling of deodorants. The true remedy for this evil is to have the industry transferred to floating hulks in the harbour, or to the mainland.

“At the telegraph-station the drainage is good, the only fault being that the earthenware pipes are unnecessarily large. They are, however, exceedingly well flushed, and no nuisance is ever observed. All the telegraph houses are supplied with water-closets with water waste-preventing cisterns. Farmers’ houses throughout the islands, generally speaking, have no drainage. A manure heap is allowed to ferment in close proximity to the dwelling, and liquid filth is allowed to run away into rude channels to percolate where it will. Having no sanitary office in the locality, I cannot bring these defects before the authorities. If Valentia is to become a health resort, however, a good deal of sanitary work must be undertaken. For houses near the sea, the fall is good for drainage. Elsewhere earth-closets would be a preferable system.

VALENTIA, Co. KERRY, LAT. 51° 56' N.; LONG. 10° 15' W. 30 FEET ABOVE SEA-LEVEL.

MONTH.	Barometer at 8 a.m. Means 1871-95.	TEMPERATURE OF AIR, 1871-1895.								Rainfall Means (inches) 1890-1895.	Bright Sunshine Means 1881-1895.	
		Dry Bulb 8 a.m.	Wet Bulb 8 a.m.	Daily Maximum.	Daily Minimum.	Maximum.	Years.	Minimum.	Years.		Hours.	Per cent. of Possible Duration.
January	" 29-894	44-0	42-7	49-0	39-8	56	1876, 78	20	1894	6-31	56-1	22
February	29-917	44-3	42-6	49-5	40-3	58	1891	22	1895	4-89	73-9	27
March	29-929	44-8	42-8	51-0	40-3	64	1871, 94	27	1885, 91, 92	3-87	135-3	37
April	29-871	48-4	45-9	54-3	43-0	70	1892	30	1879, 92	3-67	171-5	42
May	29-967	52-9	49-7	58-1	46-5	74	1884, 95	34	1877, 85	3-13	200-4	43
June	29-984	57-4	54-5	62-5	51-2	81	1887	40	1875, 80, 82	3-34	203-4	14
July	29-937	59-0	56-4	63-9	53-6	80	1878	43	1885	4-23	153-8	31
August	29-921	59-3	56-9	64-4	54-2	80	1893	42	1890	4-85	146-0	33
September	29-961	56-4	54-1	61-8	51-3	78	1895	37	1885	4-38	130-4	35
October	29-879	51-0	48-8	56-3	46-3	65	1873, 76, 77, 78, 79, 80, 82, 86	28	1892	5-57	104-2	32
November	29-867	47-4	45-5	52-3	42-9	63	1881	27	1890	5-03	63-8	25
December	29-900	45-0	42-9	49-9	40-4	57	1884, 88	24	1886	5-93	43-9	19
	29-919	50-8	48-6	56-1	46-8	81	1887	20	1894	5-580	1687-7	32
				51-0								

Cesspools and underground drains at a distance from the sea are, I think, objectionable.

“With reference to water supply it may be said that up to the present surface water only is consumed in Valentia. This is procured from shallow wells and land-springs, and in a few instances rain-water is used. The telegraph-station and village of Knightstown are presently supplied from the same source, with this difference, that the telegraph supply is very carefully filtered through sand and gravel, while the village supply is very indifferently filtered.

“All Valentia waters show an undue amount of chlorine, but after careful study, I have come to the conclusion that the source of this is the sea-spray, and not animal pollution. The telegraph water gives 4·7 parts per 100,000 of chlorine, an amount which, in inland localities, might justly excite suspicion. Its hardness is about 5·5 degs. There is a considerable amount of albuminoid ammonia, but this is clearly of vegetable origin. No diseases traceable to water have arisen in the telegraph-station since my appointment as medical officer six years ago, and I think, generally throughout the island, that water-borne disease is very rare.

“In consequence of failure in the amount of water required by the telegraph operators in the spring and early summer of some recent years, boring operations are presently being carried out. Water was struck about 30 feet from the surface and in good amount, but its quality was not satisfactory, on account of its large impregnation with iron and its strong odour of sulphuretted hydrogen. On deeper boring the quality improved, and by piping the bore-hole down to exclude the strongly ferruginous water first found, a potable supply will, I think, be obtained.

“The last sample examined contained the same amount of chlorine as the surface water, but had double the hardness and still about one-third of a grain of iron to the gallon. This quantity is not considerable, and will probably fall out of solution on storage. Organically it is pure. In support of my opinion that the sea is the source of so much chlorine in our waters, I examined freshly falling rain recently from my own roof, and found it to contain 1·9 parts per 100,000 of chlorine. Salt spray is readily carried by the winds, and must be the source of the excess of chlorine.

“With reference to the prevalence of particular diseases, I must

be brief, as I do not hold any poor-law appointment, and can only speak from impressions formed.

"Anæmia and Debility.—I should say that neither are common. I have met a few cases of pronounced anæmia amongst servant-girls, but not many. One case in a little child attracted my notice as I was driving round the island. The markedly anæmic face made me dismount to make inquiries. I found, although a cow was kept, that this child never tasted milk. It had all to go to make the butter, and the parents fed this two-year-old infant on bread and tea. Of course the anæmia was easily understood.

"Scrofulous Diseases.—These must be rare. I have seen none.

"Phthisis.—Exceedingly rare. My experience is six or seven cases in as many years, and mostly amongst those who are not natives.

"Bronchitis and Catarrh.—Not common.

"Pneumonia.—I have had to deal with a few cases both of the croupous and catarrhal types, but only a few.

"Pleurisy.—No case seen by me.

"Asthma.—No case of spasmodic asthma observed.

"Acute Renal Dropsy.—I do not think this at all usual.

"Chronic Albuminuria.—I have heard of one or two cases only.

"Calculus and Gravel.—I do not think these complaints exist here.

"Rheumatism and Neuralgia.—I have met with no case of acute rheumatic fever, but have seen several subacute cases, and also a good deal of neuralgia. The latter proceeds, I think, for the most part from diseased teeth, and I do not think the climate should be held in any way responsible for it.

"Skin Diseases—Not prevalent.

"Malarial Affections.—Non-existent.

"Typhoid Fever.—I have met two cases only—one imported from Kanturk, co. Cork, the other the result of drinking well-water, which I found seriously polluted on examination.

"Diarrhæa.—Not common, even in July, August or September.

"Scarlet Fever.—A few cases occur annually in the island, but are always imported, usually from Cahirciveen.

"Diphtheria.—About six years ago, four or five sporadic cases occurred—none since. At that time I traced the first case to importation from London by the wife of a telegraph clerk.

"Endemic Sore Throat.—Unknown.

"A recent epidemic of *measles* was attended with about twenty deaths, amongst whom unfortunately were several adults. Most of these deaths resulted from secondary bronchial and pneumonic complications, and the widespread character of the epidemic was due to the fact that a great many years had elapsed since the last visitation of measles. In a place circumstanced as Valentia is, I hold that zymotic diseases should not prevail. I base this opinion upon my own experience within the past six years, in which I have had to deal in turn with diphtheria, scarlet fever, measles, typhoid, and whooping-cough. In every instance, with the exception of one case of typhoid, I have traced the origin to an outside source.

"The most common cause of death in Valentia seems to me to be old age. The local registrar, who is not a medical man, informed me some time ago that the large number of deaths of persons aged eighty upwards attracted the notice of the Registrar-General, and Valentia was referred to specially in one of his Quarterly Reports on this account.

"I have personal knowledge that one case of hay asthma of many years' standing has quite disappeared since the patient took up residence in the island some years ago. In this case, the asthmatic symptoms were well pronounced—chloroform having been used now and then for their relief. The patient has not experienced as much as a sneeze since he came to Valentia. I think the island deserves a trial for troublesome cases of this disease, for which the high relative humidity of Valentia seems suitable.

"As a health resort for cases of incipient phthisis, I also think that Valentia would give good results. The disease is not a prevalent one amongst the natives, who live chiefly by farming and fishing combined, and spend most of their time in the open air.

"PATRICK LETTERS."

From **Cahirciveen** the visitor is carried back by rail to either Tralee or Killarney. The route is extremely picturesque. After leaving Cahirciveen the line rises several hundred feet to a mountain station called Kells—on one side stands Knocknadob, 2,266 feet; on the other, Coomacarrea, 2,542 feet, belonging to the Iveragh range. A steep incline thence carries the line on to the southern shore of Dingle Bay, another of the Kerry fiords. The train passes through the beautiful valley of Glenbeigh and

skirts Caragh Lake, from which there is a magnificent view of Carran-tual, the highest mountain in Ireland (3,414 feet), and the precipitous range of the Macgillicuddy Reeks.

From the railway line a glorious panorama spreads out before the eye along the northern shore of Dingle Bay. In the extreme west-north-west are the Blasket Islands out in the open Atlantic. The mainland ends at Slea Head (766 feet), with the sea cliffs of Mount Eagle (1,695 feet) a mile or more to the northward. Further away to the north-west Brandon Hill rises to 3,127 feet. Due north is Beenoskee (2,713 feet), and to the north-eastward in the direction of Tralee the Slieve Mish range towers to 2,796 feet in Baurtre-gaum, and 2,715 feet in Caherconree. In the foreground are the winding shores of the Dingle Peninsula from Slea Head to Castle-maine Harbour, and nearer still the deep blue waters of the bay.

GLENBEIGH.

Glenbeigh (or Glanbehy) is beautifully situated on the side of a wooded valley through which a mountain stream, the Behy, flows into Rossbeigh Creek from its source in Lough Coomasaharn, celebrated for its awe-inspiring precipices. There is a comfortable hotel near the railway-station, but it is distant about a mile from the shore, where there is good sea-bathing on a strand upwards of 2 miles in length. The Caragh and Dooks 9-hole golf-links are on the neighbouring sands of Rossbeigh Peninsula at the head of Dingle Bay. At Dooks the railway company have placed a flag station for the convenience of golfers. In addition to bathing and golf, Glenbeigh offers the attractions of both fresh and salt-water fishing, and of boating.

CARAGH LAKE.

Caragh Lake is a station on the Cahirciveen and Valentia branch of the Great Southern and Western Railway, 7 miles from Killorglin, whence there is a fine drive of 13 miles by road to Killarney along the river Laune. The Southern Hotel on the side of the beautiful Caragh Lake is within half-a-mile of the railway-station. The house is most picturesquely situated on the wooded

shore of the lake, commanding a full view of Carran-tual and the Macgillicuddy Reeks. The scenery of this locality is unrivalled even by Killarney. To the lover of nature the attractions of Caragh are innumerable, whilst for the sportsman there is salmon and trout fishing on the lake and river, rough shooting and golf-links, all within a short distance.

A salmon and trout hatchery has recently been erected in the hotel grounds, and is an object of considerable interest.

Caragh Lake curves inland for a distance of $3\frac{1}{2}$ miles, penetrating the heart of the mountains. Some two miles up the Caragh river is the village of Glencar. A little beyond it Glencar Hotel stands on rising ground in the midst of a grove of fir-trees. This hostelry is the headquarters for shooting and fishing. The shooting is free, and extends over 25,000 acres. From Glencar there is a fine drive by a new road through the mountains across the Kenmare Peninsula to Parknasilla. The scenery of the southern end of the valley of Glencar is wildly magnificent. The route then lies through the Pass of Ballaghbeama, a deep and narrow defile through mountains which rise abruptly 2,000 feet or more on each side of the gorge. Lough Brin is then passed, and the descent to the sea is made by the valley of the Blackwater, and so on to Parknasilla. From Caragh Castle to Parknasilla is about 32 miles. Another fine drive is from Glencar to Waterville by Loughs Derriana and Namona in the heart of the Iveragh and Dunkerron mountains, down the valley of the Coomeragh river, and on by the northern shore of Lough Currane.

The Dingle Promontory is the most northern of the remarkable mountainous prolongations of land towards the south-west, formed by the anticlinals of Old Red Sandstone in the west of Cork and in Kerry. The Irish name for this peninsula is Corkaguiny. A backbone of lofty mountains, rising to 3,127 feet in Brandon Hill in the north-west, runs for more than 30 miles through the district, the northern entrance to which is at Tralee (population, 9,318), the largest seaport in Kerry, of which it is the county town. The name is Traigh-Li, in the *Annals of the Four Masters*, that is, "The Strand of Li." From Tralee, a good road runs westward along the northern coast by Blennerville, a suburb which is also connected with Tralee by railway and by a ship-canal. This road skirts the

shores of Tralee Bay and Brandon Bay, which are separated from each other by a long low sandy promontory running 4 miles due north from Castlegregory, a small town at the foot of Beenoskee, 2,713 feet high. Brandon Bay is fringed by a fine strand, and it is bounded on the west by Brandon Head, a spur of the mighty pile of Brandon Hill, on the seaward side of which there are tremendous precipices. The Tralee and Dingle Light Railway, 31 miles in length, connects Tralee with the southern face of Dingle Promontory, the summit-level on the line being as much as 800 feet above the sea. Further west, a road leads across the mountains from Brandon Bay to Dingle by Connor Pass, a rocky defile between Brandon Hill and Connor Mountain (2,134 feet), attaining a summit-level of no less than 1,300 feet. The road commands splendid views of the Iveragh mountains and Dingle Bay.

Along the north shore of Dingle Bay a road runs to Dingle direct from Castlemaine, the southern entrance to the promontory as Tralee is the northern. This coast-line is of course well protected by the mountain ranges from northerly winds, and it also receives the full benefit of the sunshine in fine weather. On the other hand, the mountains keep the sky cloudy in unsettled weather, and rain falls, if not heavily, at least frequently—drizzle and Scotch mist being of common occurrence. On or near the coast there are a few seaside places which deserve to be mentioned.

INCH.

Inch is a pretty village, 11 miles west of Castlemaine, at the head of a sandy peninsula of the same name, which juts out to a distance of 3 miles into Dingle Bay nearly opposite to Rossbeigh Point, the northern end of Rossbeigh Peninsula already referred to. Both these peninsulas consist really of a range of sand-hills from 30 to 40 feet high.

ANASCAUL.

Anascaul, 10 $\frac{1}{4}$ miles east of Dingle by rail, is prettily situated not far from the sea-shore.

DINGLE.

Dingle (population, 1,764) stands at the head of a sheltered bay called Dingle Harbour, on the west shore of which is Burnham, the seat of Lord Ventry. Dingle is one of the most westerly towns in Ireland. Its connection with Tralee by railway has already developed the fishing industry in the district.

Ventry is a village 3 miles west of Dingle at the extreme north of Ventry Harbour, which is fringed by a fine bathing-strand.

Smerwick is on the west coast of a fine sheltered bay, Smerwick Harbour. Near it there are ranges of splendid sea-cliffs. The chief cliffs are Sybil Head and the Three Sisters, to the west; Ballydavid Head and Brandon Head to the east. The height of these stupendous cliffs varies from 700 feet to 1,000 feet.

A fine description of a sunset of exceptional beauty seen from Sybil Head is given by the late Dr. William Stokes, F.R.S., D.C.L., in a letter written by him many years ago to William Carleton, the Irish novelist. The description of the scene concludes as follows:—

“The cliff from which we contemplated this scene was covered with lichens and mosses of various colours. It stood out mighty and stupendous, facing the crimson sun, whose deep empurpled light touched the whole magnificent mass with colour. Then the sun finally sank, and two eagles shot out far below us from the side of the cliff, and rose circling and wheeling round till they disappeared in the darkness. The rich colour faded away, the deep-tinted fires grew fainter and fainter, the ideal world vanished, darkness succeeded, the winds as it were leaped into motion, the mighty waters began to heave, and there remained before us nothing but the desert bosom of the dark Atlantic.”

Immediately south of Sybil Head is Ferriter's Cove, a wild, rock-bound inlet of the Atlantic Ocean, where, in 1579, Dr. Nicholas Sanders, the Pope's Nuncio, and 80 Spaniards landed and built a fort on a rocky eminence overlooking Smerwick Harbour. This fort was called *Fort-de-l'Oro*, because one of Frobisher's ships, supposed to be laden with gold (but in reality with pyrites), had been wrecked here the year before. About 3 miles south of Ferriter's Cove and 5 miles west of Ventry on the Blasket South is what Dr. Alexander Knox¹

¹ *The Irish Watering Places*, p. 241 : Dublin. Wm. Curry and Co., 1845.

calls "The beautiful and perfectly sheltered vale of Dunquin," in his opinion a favoured spot well adapted as an eligible health resort in pulmonary cases.

On the north shore of Tralee Bay there is fair sea-bathing. A branch of the Waterford, Limerick and Western Railway runs from Tralee to Spa ($4\frac{1}{2}$ miles), Kilfenora ($6\frac{1}{2}$ miles), and Fenit (8 miles). There is deep water at Fenit, where a new pier has been constructed, enabling large vessels to discharge their cargoes. There are but two passenger trains each way on week-days, and but one train on Sundays, on the Tralee and Fenit branch.

BALLYBUNION.

Ballybunion (population, 253) is a small but popular watering-place on the open sea at the mouth of the Shannon. It is prettily situated 10 miles distant from Listowel, on the Waterford and Limerick and Western Railway. Ballybunion is very accessible by rail. The line just mentioned carries visitors from Limerick in one direction and in the other from Tralee by Ardfert, where there are renowned ecclesiastical ruins, and Listowel (Tuathal's Fort), a fine and prosperous town of 3,566 inhabitants, about 7 miles south of which is the famous Rattoo round tower, 92 feet high, and 48 feet in circumference at its base. Listowel stands on the banks of the Feale, celebrated for its salmon and trout.

From Listowel, Ballybunion is reached by a remarkable railway, on the Lartigue principle of a single rail, this being the only example of such a line in the United Kingdom. The engine and carriages run on a raised central rail supported by trestles $3\frac{1}{2}$ feet high, which are kept in position by side-rails resting on the ground.

The coast scenery near Ballybunion is of extraordinary interest, gigantic cliffs being hollowed out beneath into caves extending into intricate passages and recesses. The largest of these caves, known as "Neptune's Hall" or the "Pigeon Cave," is from 70 to 80 feet in height. At Doon, $1\frac{1}{2}$ miles north, there are some striking natural arches and isolated rocks, carved out by the action of the Atlantic waves. Knockamore, a hill 880 feet high, rises to the north-eastward, adding to the fineness of the scenery.

KILLARNEY.

Killarney (population in 1901, 5,656) is, after Tralee, the most important town in Kerry. It is about a mile distant towards north-east from the shore of the lowest of the far-famed Lakes of Killarney, to which indeed it owes any prosperity it possesses. The town stands in the midst of a district celebrated for the richness and luxuriance of the vegetation. Nowhere in the British Isles is the foliage of the trees and shrubs more beautiful. Hence perhaps the name Killarney, in Irish *Cill-air-neadh*, the Church of the Sloes. There is ample and first-class hotel accommodation in and near the town.

The Great Southern Hotel is close to the railway-station, and stands in ornamental grounds, 20 acres in extent. The Royal Victoria Hotel is $1\frac{1}{2}$ miles west of the town, situated in beautiful grounds, which slope down to the water's edge on the northern shore of Lough Leane, as the lowest and largest of the three lakes is called. The Lake Hotel is near Castlelough Bay, about $1\frac{1}{4}$ miles due south of the town. The Muckross Hotel, 3 miles south of Killarney, is near the entrance to the grounds of Muckross Abbey.

The Lakes of Killarney are three in number, the Upper Lake, $2\frac{1}{2}$ miles in length by half-a-mile in breadth; the Middle (sometimes called Tore or Muckross Lake), 2 miles long and 1 broad; and the Lower Lake, or Lough Leane, $5\frac{1}{2}$ miles long and $2\frac{1}{2}$ broad. The three are connected with one another by channels: the entire journey therefore, from the foot of the Lower to the head of the Upper Lake, can be performed by boat.

There is a difference in level between the upper and lower lakes of only 4 feet, the upper being 70 feet, the lower 66 feet, above the sea. The Upper Lake, 430 acres in area, embosomed in mountains and studded with richly-wooded islands, probably bears away the palm for beauty.

The waters of the Lakes of Killarney are carried to the sea by the river Laune, which flows by Killorglin into Castlemaine Harbour, the innermost recess of Dingle Bay.

The Climate of Killarney.—A meteorological station of the second order had been until recently at work for many years at Killarney under the superintendence of the Ven. Archdeacon G. L.

Wynne, M.A., D.D. The Archdeacon read a paper on the local climate before the Royal Meteorological Society on April 21st, 1886.¹

Temperature.—The climate is determined partly by the geographical position of Killarney, placed as it is within 14 miles of Dingle Bay, 18 miles of Kenmare River, and 40 miles of Valentia Island. It has thus the benefit of proximity to the Gulf Stream. But the temperature is locally modified by a remarkable and unlooked-for depression of the minimum readings throughout the year. It might fairly have been expected, from the reputation for mildness and relaxing air which is borne by Killarney, that the mean temperature would exceed the average of the whole of Ireland south of the latitude of Dublin. Such is not the case. A comparison of the observations taken at Killarney with those recorded at Valentia, Dublin (City and Phoenix Park), and Londonderry shows clearly that Killarney is to be credited with low minimum temperatures and low mean temperatures consequent on these, as the maxima are comparatively high.

Archdeacon Wynne considers that the solution of the problem seems to lie in the fact that Killarney lies in a great irregular basin, surrounded by mountain ranges for about a third, and by hilly plains elevated some hundreds of feet above the lakes through the great portion of the remaining two-thirds of the circle. The tendency of the heated air to ascend, leaving its place to be occupied by a colder stratum, probably explains the comparative coolness of Killarney at and near the lake level, a fact subversive of the popular opinion that Killarney has a very mild climate indeed.

Rainfall.—The following table gives the annual rainfall for the four years, 1882-1885, at three stations in and near Killarney, comparing the figures with those for the district known to the Meteorological Office as "Ireland South," and for the city of Dublin.

From this table it appears that what may be an excessively wet year in the south-west of Ireland may be marked by comparative dryness on the east coast—an observation often verified by the comparison of monthly totals.

¹ This paper was published in the *Quarterly Journal* of the Society, vol. xii. no. 59, p. 193. July 1886.

TABLE OF ANNUAL RAINFALL.

YEARS.	KILLARNEY.	GAP OF DUNLOE.	MANGERTON.	IRELAND, SOUTH.	DUBLIN.
1882	58·13	—	—	40·0	31·18
1883	70·06	102·3	96·0		29·35
1884	63·76	101·9	83·0*		20·47
1885	52·69	89·2	88·1		26·61

Amount of Cloud.—Five years' observations bring out the fact that the mean proportion of cloud, varying little with the seasons, is slightly over 70 per cent. It is about the same at Londonderry, but is substantially lower in Dublin, namely, 59 per cent. Archdeacon Wynne somewhat pathetically observes that the percentage of cloud at Killarney is "a proportion which in England is characteristic of towns in the Black Country, and of such places as Bolton."

THE FOLLOWING TABLE GIVES THE RAINFALL AT STATIONS IN THE EXTREME S.W. OF KERRY.

RAINFALL AT DARRYNANE ABBEY (CO. KERRY).			RAINFALL AT WATERVILLE (IVERAGH LODGE), CO. KERRY.			RAINFALL AT KENMARE, DERREEN (CO. KERRY).		
Rain-gauge Diameter, 5 inches. Height above Ground, 1 foot. Height above Sea-level, 13 feet.			Rain-gauge Diameter, 5 inches. Height above Ground, 1 foot. Height above Sea-level, 86 feet.			Rain-gauge Diameter, 5 inches. Height above Ground, 1 foot. Height above Sea-level, 74 feet.		
Year.	Inches.	Days on which .01 or more fell.	Year.	Inches.	Days on which .01 or more fell.	Year.	Inches.	Days on which .01 or more fell.
1890	53·01	268	1893	45·13	205	1889	61·85	177
1891	50·23	235	1894	54·19	239	1890	70·08	218
1892	54·35	250	1895	48·33	219	1891	73·00	203
1893	42·46	214	1896	46·39	242	1892	65·80	206
1894	50·19	241	1897	62·25	255	1893	55·92	163
1895	50·53	218	1898	49·11	235	1894	68·12	190
1896	44·66	232	1899	55·02	220	1895	61·72	205
1897	54·85	255	1900	53·45	255	1896	58·15	202
1898	48·51	247				1897	72·63	222
1899	44·30	226				1898	60·20	200
1900	40·53	249				1899	75·95	207
						1900	73·79	235
Average } 11 years } 1890-1900. }			Average } 8 years } 1893-1900. }			Average } 12 years } 1889-1900. }		
48·51			51·73			66·43		
239			224			202		

THE SHANNON.

Rising on the western slopes of Cuilcagh Mountain (2,188 feet), on the borders of Fermanagh and Cavan, this largest of Irish rivers runs a majestic course of more than 220 miles to fall into the Atlantic Ocean between the headlands of Loop Head in Clare and Kerry Head in Kerry. These headlands are 7 miles apart. The catchment basin of the Shannon is no less than 6,946 square miles. In its course the Shannon passes through a chain of large lakes, of which the chief are Lough Allen, Lough Ree (north of Athlone), and Lough Derg, the third largest lake in Ireland. From Athlone to Killaloe the shores, lakes, and islands of the Shannon present an ever-changing panorama of beautiful and romantic scenery. The Lower Shannon from Limerick to the ocean is 56 miles in length, of which the last 40 miles afford a free and unimpeded navigation at all states of the tide.

THE CITY OF LIMERICK.

Limerick is a city and Parliamentary borough, situated at the inland extremity of the estuary of the Shannon, $119\frac{1}{2}$ miles west-south-west of Dublin, in lat. $52^{\circ} 35' N.$; long. $8^{\circ} 35' W.$ The population of the county of the city was, in 1901, 38,085, inhabiting about 6,000 houses.

Limerick, the "City of the Violated Treaty," presents many features of interest to the visitor—King John's Castle, St. Mary's Cathedral, the Treaty Stone, and, above all, the broad waters of the Shannon, crossed by three fine bridges,—Thomond Bridge, Wellesley (now Sarsfield) Bridge, and Athlunkard or Park Bridge—all of which have played an important part in the history and topography of the city. From the city there are two routes to the coast of Clare and its watering-places. One is by water, a steamer leaving almost daily for Kilrush, which is only 9 miles by rail from Kilkee. The other route is by rail to Ennis, and thence by the narrow-gauge West Clare Railway to Lahinch, Miltown Malbay, and Kilkee. The last-named favourite seaside resort is very bracing—the neighbouring cliffs are famed for their grandeur, and the sea-bathing is excellent. Lahinch stands at

the south-eastern extremity of Liscannor Bay. It is noted for its golf-links, and in connection with these, the Golf-Links Hotel is all that can be desired in respect of site, equipment, and *cuisine*.

From Lahinch a most enjoyable drive is by Liscannor to the stupendous Cliffs of Moher, which tower to a height of nearly 700 feet above the Atlantic, and thence to Lisdoonvarna, well known for its sulphur and chalybeate springs. Splendid views of the Arran Islands, Galway Bay, and the mountain ranges of Galway and Connemara are commanded by the road running from the Cliffs of Moher to Lisdoonvarna. The drive may fitly end at Ennistimon, where there is a fine cascade on the Cullenagh river. It is a station on the West Clare Railway, so that the return journey to Dublin is easy *viâ* Ennis, Limerick, and Limerick Junction to Kingsbridge, or *viâ* Ennis and Athenry to Broadstone, Dublin, over the Waterford and Limerick and Western Railway, and the Midland Great Western Railway.

Along the shores of the splendid estuary of the Shannon there are several places where bathing is enjoyed in summer. Many of these can be reached by steamer from Limerick, the vessels of the Waterford Steamship Company performing a daily service on the Lower Shannon. There are landing piers at Ringmoylan (for Palskenny), Beagh (for Askeaton), Foynes (24 miles from Limerick), Killadysert (at the mouth of the Fergus river which flows into the Shannon through a broad but shallow estuary on its north side)—here the steamer calls three days weekly: Glin, near Glin Castle, the ancient seat of the Knights of Glin, who have held it in succession for nearly seven centuries: Tarbert (35 miles from Limerick), very picturesque with its wooded headland, lighthouse and battery: Redgap, and finally Kilrush (44 miles from Limerick) on the Clare coast, are the other stopping-places of the steamer. There is a railway from Limerick to Foynes, 26½ miles, a branch of the Waterford and Limerick and Western Railway. At Foynes there is a meteorological station. The harbour is sheltered from the north by Foynes Island.

COUNTY CLARE.

The county Clare, of which the ancient name was Thomond, extends from the estuary of the Shannon on the south to Galway

Bay and the co. Galway on the north, its extreme length being 67 miles. It is bounded on the west by the Atlantic Ocean, on the east by the river Shannon and Lough Derg. Its average breadth is 21 miles, its extreme breadth being 38 miles. The area of the county is 1,294 square miles. Carboniferous limestone is the prevailing geological formation, and for many miles north of Ennis, the stony and rocky character of the surface attracts attention, hummocky masses of rock scattered broadcast suggesting the "perched blocks" of glacial action. The western sea-line is bold, rugged, and in places precipitous. The ceaseless thundering of the Atlantic waves through the ages along this iron-bound coast has sculptured the rocks of carbonaceous slate into fantastic pinnacles and winding caves. For a distance of 5 miles north of Liscannor Bay, the giant Cliffs of Moher rise from the sea almost in the perpendicular to heights varying from 400 to 600 feet.

Clare is hilly rather than mountainous. Slieve Callan, some 7 miles inland from Miltown Malbay near the west coast, rises to 1,282 feet. In the east the highest elevation is 1,758 feet in the Slieve Bernagh range near Killaloe. A peculiar but not an attractive feature in the county is the scarcity of trees. This is chiefly owing to the want of shelter from the vehement westerly gales which sweep across the country from the Atlantic. Only in sheltered glens are trees found along the west coast. Hawthorn-bushes, when they grow at all, lean sharply towards the east, and their topmost branches are sheared off by the wind as if cut with a pruning-hook.

The most prominent headland is Loop Head at the mouth of the Shannon in the extreme south-west, 16 miles from Kilkee. From the lighthouse, which stands 500 yards south-east of the extreme point at an elevation of 277 feet above high water, there is a striking view in clear weather. It embraces the mountain ranges from the Macgillicuddy Reeks in Kerry to the Twelve Bens of Connemara, the estuary of the Shannon towards the east, and the Arran Islands to the north.

The principal watering-places are Kilrush, Kilkee, Miltown Malbay, Lahinch, Ballyvaughan, and Burren on Galway Bay.

KILRUSH.

Kilrush (population in 1901, 4,180), a good market and trading town and a seaport, well sheltered by Scattery Island on the east side of the entrance to a shallow inlet called Poulanasherry Bay. There is an excellent harbour, and in the season some sea-bathing, but the superior attractions of Kilkee, to which it serves as an approach, militate against its success as a watering-place.

KILKEE.

Kilkee (population 1,555) is admittedly one of the finest watering-places in the British Isles. It is now easily reached by steamer from Limerick to Kilrush, thence by rail a distance of 9 miles, or the visitor may travel the whole way by the West and South Clare Railways from Ennis. The town is built on a semi-circular strand along the shores of a small inlet, called Moore Bay, or Kilkee Bay. It is sheltered on the west and north by cliffs, and the entrance to the bay is protected by a great ledge of flat rocks, called the Duggerna Rocks. Over these the Atlantic swell breaks with magnificent effect in rough weather. The sands are beautiful, and are washed by "a sea as clear and blue as the finest sapphire" (Dr. Johnson). The water, fresh from the open Atlantic, is indeed clear as crystal, buoyant, and invigorating. The air is very pure and bracing, and the cliff walls to south and north of the bay are extremely fine. At Farrihy Bay, 4 miles to the northward, the cliffs are especially imposing, and many large caves have undermined them. Kilkee Cave, properly so called, is about 300 feet in length, and varies from 30 to 60 feet in height. From the roof hang innumerable stalactites, which glisten in the light of a magnesium wire. The recesses of this cave may be explored in a boat. At Ross, in the direction of Loop Head, the process of excavation has assumed another type, resulting in the formation of gigantic arches or natural bridges. Bishop's Island is a huge, bold, escarped rock, on which St. Senanus is said to have constructed a bee-hive oratory and a "house." Dr. Alexander Knox, in his work on *The Irish Watering Places*,¹ says that near Kilkee wild flowers are found on the cliffs in great beauty and variety, sea anemones of every shade of colour, and many shells.

¹ Dublin: Wm. Curry, junr., and Co., 1845.

The only rare shell however is that of a species of the genus *Ianthina*, a large blue gastropod peculiar to the western coast. The shell-fish in question, called *Purple-shell* and *Violet-snail*, discharges a purple fluid, and floats its shell by means of a transparent raft, formed of air-bubbles united together in hardened mucus. The Tyrian purple of the ancients was obtained in part from molluscs of the genus *Ianthina*. Carragheen moss also abounds on the rocks, and in times of famine has preserved life. The native boat used along the coast of Clare is the corragh, which consists of a willow framework covered with pitched or tarred linen, and provided with a rude form of rudder.

There are several mineral springs in the vicinity of Kilkee. Dr. Knox¹ mentions Kilkee Spa, the chemical ingredients of which are iron, salts of sodium and magnesium, and carbonic acid; Foohagh or Fougha Spa, slightly chalybeate and containing sulphide of hydrogen; and Lisdeen Spa, containing iron and saline matters, some 2 miles east of Kilkee.

The one drawback to Kilkee as an ideal watering-place is the almost total absence of trees from the district, and the consequent want of shade. This is partially compensated by the shelter from the sun afforded by the rocks along the coast.

The accommodation for summer visitors at Kilkee is good as regards hotels, lodgings, and private houses. In winter many of the houses are closed, and indeed the place cannot be recommended as a winter residence, because of the strength of the westerly winds and the generally changeable weather.

Near Doonbeg, a hamlet 5 miles north-east of Kilkee, and also a station on the South Clare Railway, the Doughmore sand-hills rise to a height of 100 feet above sea-level in places.

MILTOWN MALBAY.

Miltown Malbay, a town of 1,267 inhabitants, is situated 1½ miles inland from Spanish Point. It stands on high ground, and was formerly the terminus of the West Clare Railway, which however is now worked in conjunction with the South Clare Railway which runs by Mogasta Junction to Kilrush southwards, to Kilkee westwards. At Spanish Point on the bay, that is Mal-

¹ Dublin: Wm. Curry, junr., and Co., p. 315, 1845.

bay, there is excellent bathing. Some fine villa residences are springing up in the neighbourhood, and there is a large but somewhat antiquated hotel—the Atlantic Hotel—overlooking the sea, which washes under its very windows. Spanish Point received its name from the fact that here were buried the crews of several vessels of the Spanish Armada lost on this dangerous coast in September 1588, while on their disastrous retreat to Spain. Malbay is in part protected towards the south-west by Mutton Island, of which the Irish name is much more euphonious—Inishnaageeragh, the island of the sheep. About 2 miles north of Miltown Malbay are the old ruins of Feagh Castle, near which is a remarkable Puffing Hole. In certain states of the sea and tide an immense volume of water spouts through an opening in the cliff, ascending to a great height, and in the sunshine assuming the appearance of a giant iris.

The following table shows the rainfall at Miltown Malbay during the 12 years 1889–1900.

RAINFALL AT MILTOWN MALBAY. C. C. CHARE.

Rain-gauge—Dropper, 5 inches. Height above Ground, 1 foot. Height above Sea-level, 400 feet.		
Year.	Inches.	Days on which 101 or more fell.
1889	44.32	237
1890	49.46	264
1891	42.27	227
1892	41.94	244
1893	39.68	226
1894	46.29	251
1895	38.44	215
1896	44.02	212
1897	60.79	—
1898	46.51	248
1899	44.29	229
1900	55.94	254
Average	46.11	237
12 years		
1889–1900.		

(In 11 years.)

LAHINCH.

Lahinch (population, 257) is a village at the eastern end of Liscannor Bay. It has become popular within recent years because

of its splendid golf-links, 3 miles in circuit, and an 18-hole course. The links stretch across the sand-dunes, which back the fine stretch of sands running north-westward in the direction of Liscannor. On these sands there is good and safe sea-bathing. Close to the railway-station is the Golf Links Hotel, finely situated on a cliff overlooking Liscannor Bay and the Atlantic. It is built of wood on the Norwegian plan, and is fitted with hot and cold sea and fresh-water baths. Golfers are granted travelling privileges by the Great Southern and Western Railway Company, and the Lahinch Golf Club is one of the best in Ireland. There is another comfortable hotel in the town, namely the Aberdeen Arms. The sea-fishing in Liscannor Bay is excellent, and in the Cullenagh river which flows by Ennistimon into the bay there is very good trout fishing. There are very fair cycling roads in the neighbourhood, as well as pretty rides. The following places of interest may be visited in daily excursions or drives from Lahinch:—(1) the Cliffs of Moher and O'Brien's Tower ($4\frac{1}{2}$ miles); (2) Hag's Head, Cliffs of Moher ($6\frac{1}{2}$ miles); (3) Lisdoonvarna and its Spas, and Burren, an oyster district (7 miles); (4) Miltown Malbay (5 miles); (5) Kilfenora, with its old cathedral and beautiful Irish cross (6 miles); (6) Ennistimon cascade and glen ($2\frac{1}{2}$ miles); (7) Moy Glen (1 mile); (8) Ballyvaughan, for Galway and Connemara (14 miles). To Ballyvaughan a four-horse coach, under Government subsidy, runs daily from Ennistimon, *via* Lisdoonvarna, during the summer season, June to September inclusive. The Galway Bay Steamboat Company run their steamers at stated times from Galway to Ballyvaughan and the Islands of Arran and Kilkerrin.

ENNISTIMON.

Ennistimon is a well-to-do town of 1,200 inhabitants, $2\frac{1}{2}$ miles inland and due east of Lahinch. It is beautifully situated in a well-wooded glen on the banks of the Cullenagh river. This stream, within the precincts of the town, falls over a series of great ledges of rock, forming a cascade which in time of flood is extremely fine. The best views of the river and cascade are from the bridge across the river in the town and from the terrace of Ennistimon House, the seat of Henry V. Macnamara, Esq., D.L. Ennistimon is the highway to **Lisdoonvarna Spa**, which is distant 8 miles to

the northward. A special description of the Spa and of its waters will be found in another portion of this volume (see p. 578). Good sea-bathing may be had at the Bay of Doolan, or on the sandy beach of Ballaghaline, a little to the north of it. The situation of Lisdoonvarna is bracing, and the higher grounds command some good views to the north and east. There are some pretty and romantic glens in the neighbourhood of the spas, and a small river, which runs a serpentine course through deep ravines in its passage to the sea, has its precipitous banks at intervals clothed with most luxuriant verdure.

No description of this district would be complete without some allusion to the celebrated Cliffs of Moher. The stupendous natural rampart called by this name extends for some 3 or 4 miles north-eastwards from Hag's Head (407 feet), which is about $1\frac{1}{2}$ miles north-east of Caneregga Point at the north-western extremity of Liscannor Bay. The cliffs are formed of "limestone beds and superincumbent shales, passing upwards into sandy flags." They rise to a height of 668 feet as a sheer precipice at one point. From Hag's Tower, at the south-western end, a splendid view of the whole line of precipices is obtained. Another striking view is to be had from O'Brien's Tower, built as an outlook in 1836 by the late Mr. Cornelius O'Brien, at that time lord of the soil. There is a considerable export trade in limestone flags and slates carried on at Liscannor Harbour on the northern shore of the bay.

BALLYVAUGHAN.

Ballyvaughan (population, 180) is a quaint, old-fashioned village on the bay of the same name, being an inlet of Galway Bay facing northward. There are two routes to Ballyvaughan from Lisdoonvarna—1. the direct road, 10 miles' drive, passing Slieve Elva (1,109 feet) on the left. The approach to the village by this road is interesting. In the first place, from the higher level of 600 feet, maintained for a considerable distance after leaving Lisdoonvarna, splendid views are obtained of Galway Bay and of Slieve Carran (1,078 feet) towards the east. Then the descent is made by a winding hill-pass over 2 miles in length, called the "Cork-screw Road." In the crevices of the rocks near the road the rare fern *Adiantum Capillus Veneris* is found.

The other, or coast route, is much longer—17 or 18 miles. The road, after some 3 miles, descends rapidly towards the sea, leaving Ballynalackan Castle perched on a crag to the right. It then turns north 8 miles to Black Head at the entrance to Galway Bay, affording beautiful views of the Arran Isles and the coast of Galway and Connemara. Having skirted Black Head the road turns south-eastward, passing Gleninagh Castle and a Holy Well, and so reaching Ballyvaughan at 6 miles. There is fair sea-bathing at Ballyvaughan, but the main feature is that this place affords a means of communication by steamer on alternate days with Galway.

In the Barony of Burren are the famous Red Bank oyster-beds, the yield of which has fallen off seriously of late years. The amorphous limestone rock of this district gives it a barren aspect. Cromwell is reputed to have said of this Barony that it did not contain enough wood to hang a man, enough water to drown him, or enough earth to bury him.

COUNTY GALWAY.

Galway is the key to the Connemara Highlands, and also links the south-west of Ireland, which we have been traversing, with Mayo and the Donegal Highlands which have yet to be described.

The county of Galway, in the Province of Connaught, extends 62 miles from south to north, and 84 miles from west to east. Its area is 2,452 square miles. It is a land of mountain, lake, pasturage, and peat-bog. Its coast-line is deeply indented with spacious bays and harbours and studded with islands—great and small. Iron and lead ores have been found. Limestone and marble abound. In Connemara the beautiful green variegated marble called “serpentine” is successfully quarried. Near Oughterard, on Lough Corrib, black marble is obtained. Lough Corrib, which divides the county into west and east ridings, is the second largest lake in Ireland and is navigable from the sea at Galway to Cong in Mayo.

Galway Bay is an immense sheet of water, protected from the swell of the Atlantic by the natural breakwater of the Arran Islands, the largest of which is Inishmore, rising to 498 feet above the sea, 9 miles long, and with an area of $11\frac{1}{2}$ square miles. There are several villages on Inishmore, such as Kilronan, Killeany,

Oghil, Onaght, and Kilmurvey. Between this great island and the coast of Clare are Inishmaan and Inisheer, or the Eastern Isle. The whole group stretches across Galway Bay, at a distance of 25 miles from Galway, from north-west to south-east, in such a way as to suggest that in ancient times these islands formed part of the mainland, enclosing to the eastward a great fresh-water lake. Into this perhaps the Atlantic broke, so forming Galway Bay. The Arran Islands are rich in archaeological remains. Their population in 1891 was 2,907. The geological formation is carboniferous limestone, laid down in gigantic slabs, sometimes 40 to 60 feet in length, and separated by fissures and crannies, in which ferns grow in rare luxuriance, including the *Adiantum Capillus Veneris*. The dripping climate supplies water from wells rather than from streams. The islands are terribly exposed to the tempestuous westerly winds, and the Atlantic surge washes over a great portion of the rocky land in stormy weather. Although often pinched for food, the inhabitants enjoy good health and are long-lived. Typhus fever used to be prevalent, but it has become rare of late. There was however a serious outbreak in 1898. The islanders wear rude sandals, or *pampooties*, made of raw cow-hide, with the hair on the outer side. In this way they are able to walk upon the great limestone slabs which form the natural Titanic pavements of the islands. Needless to say, these storm-swept rocky islands are almost devoid of trees.

GALWAY.

Galway is a county of a town and a Parliamentary borough, situated on the north side of Galway Bay, 126 miles west of Dublin. Its population had decreased to 13,414 in 1901 from 16,959 in 1891, and 19,171 in 1881. The town contains 3,197 houses. It is a quaint old-world place with interesting architectural features in the narrow crooked back streets, in which some of the houses were built by Spanish merchants, a small court or *patio* occupying the centre and a high archway leading therefrom into the street.

Galway is built on both sides of the river Corrib, which in a short course of about 3 miles carries into the sea the abundant overflow of waters from Lough Corrib. The main portion of the

town is on the east bank of the Corrib, extending thence to the western shore of Lough Atalia, a shallow inlet of the sea. A curious suburb is called The Claddagh. It consists of several streets of cabins and cottages with thatched roofs, and is the home of the fisher-folk of Galway, who in bygone times were much more clannish than they have of late become. There is excellent trout and salmon fishing in Corrib within the precincts of the town itself.

SALTHILL.

Salthill is a suburb of, and the nearest bathing-place to, Galway, with which it is connected by a horse-tramway. It is $1\frac{1}{2}$ miles distant. Having passed through the little village, the visitor finds himself on a fine sea-front, with rising ground to the north or right hand, on which stand numerous villas with well-wooded grounds. The views from the esplanade are very fine, including the Clare coast from Black Head and Ballyvaughan and Burren. Further to the east the entrance to Kinvarra Bay is seen.

Dr. Richard J. Kinkead, Professor of Midwifery in Queen's College, Galway, has kindly favoured me with the following information. With regard to visitors there are two classes—(a) Officials stationed in the town for periods varying from a few months up to five years. For example: military men and their wives, inland revenue and customs officers, constabulary, and so on. (b) Those who come for a fortnight or for a month or two for bathing, shooting and fishing.

I. It is quite unusual for patients to come to Galway for treatment, except such country folk as come into the Galway Hospital from the neighbourhood. Occasionally invalids are amongst the summer visitors.

A. *Anæmia* and *debility* are fairly common amongst girls of from sixteen to twenty-five years; and although not confined to any class, anæmia is nevertheless most prevalent amongst the industrial class. It yields readily to treatment.

B. *Scrofula* and *tuberculous diseases* are moderately prevalent amongst the poor and the peasantry.

C. *Diseases of the Respiratory Organs*.—*Phthisis* prevails a good deal amongst these classes, and is not infrequent amongst Irish-

Americans who have returned to their native land, especially such as had settled in towns on the eastern seaboard of the States. When health fails, a good many of these emigrants come back to Ireland.

Bronchitis and *catarrh* are not very prevalent. There is however a fair proportion of chronic bronchitis among the aged. This Dr. Kinkead finds amenable to treatment. Transient attacks of *catarrh* occur chiefly in April and May.

Neither *pneumonia* nor *pleurisy* is prevalent.

Asthma is not at all common.

D. *Renal Disease*.—*Acute renal dropsy* is not prevalent. *Chronic albuminuria* is fairly common, and is often associated with granular kidney.

Calculus and *gravel* are rare.

E. *Rheumatism*, *rheumatoid arthritis* and *neuralgia* are not very prevalent—*myalgia* and *neuralgia* are the most common of this class of affections.

F. *Diseases of the skin* are not very prevalent. *Eczema* is the disease most commonly met with.

G. *Endemic Diseases*.

Malarial affections are unknown, except in the case of visitors from tropical climates.

Typhoid fever occurs sporadically, but cannot be said to be prevalent.

Diarrhœa is not prevalent.

Scarlet fever is not prevalent, but occurs in isolated instances.

Diphtheria is rare.

Endemic sore throat is not very common. It assumes the form of tonsillitis chiefly.

II. In 1897, according to the Registrar-General's Returns, 662 deaths were registered in the Galway Superintendent Registrar's district. Of these, 82 were caused by the more common "febrile or zymotic diseases," 94 by "constitutional diseases" (including 14 from cancer, 2 from *tabes mesenterica*, and 65 from phthisis), 83 by nervous diseases, 37 by circulatory diseases, 82 by respiratory diseases, 12 by diseases of the digestive organs, 15 by urinary diseases, and 3 by parturition.

There are many old people among the population.

III. The drainage system is satisfactory. The main sewers are

of concrete, egg-shaped, with good flushing. In Salthill the cesspool system is adopted in the case of detached villas.

IV. The water supply is taken from the river Corrib well above the town. It is pumped up to high-level reservoirs, from which it is in turn distributed through the town. At the intake, the water is free from sewage contamination, but it often contains vegetable matter. There are no filter-beds. The reservoir is also uncovered, and within a few yards of the high-road immediately outside the town. Houses too extend for some distance beyond the reservoir. The result of this very insanitary state of things is, that the surface of the water is in dry weather covered with dust, which eventually settles down through the water. The supply of water is adequate except in hot and dry weather. Even then a fairly adequate supply is maintained by pumping.

The Queen's College is an imposing Gothic building, with a spacious quadrangle, standing on high ground not far from Lough Atalia. It contains fine museums and a good library, and takes part in medical as well as general education. Its undergraduates seek their degrees for the most part in the Royal University of Ireland.

Three miles north-west of Galway, Lough Corrib is reached. This vast expanse of fresh-water spreads over 43,000 acres. Its shores extend for 50 miles. Its greatest breadth is 7 miles, but from Cong on its northern shore to the beginning of the river Corrib is some 27 miles. The surface of the lake is 13 feet 9 inches above high water. Its basin has been hollowed out by the solvent action of carbonic dioxide in the water on the limestone of the district.

Barna is a small village 4 miles west of Galway beyond an inlet into the sea, which is bounded on the west by Seaweed Point, a peninsula which shows large deposits of boulder-clay or "till"—that is, the deposits of clay, sand and gravel, without lamination, formed by means of the water derived from a melting glacier. On the stones imbedded in this formation well-marked glacial striation is easily recognized.

Professor E. H. Hull tells us that at Barna, probably 10 feet below high-water mark, may be seen on the strand a turf bog of several feet in depth, in which are the stumps and roots of large trees and many branches of oak and birch intermixed. The same

phenomena occur at the west side of the island of Omev, which lies off the mouth of Streamstown Bay, near Clifden.

Spiddle (population, 283) stands at the mouth of the Owenboliska river, in which there is good fishing. The town is $9\frac{1}{2}$ miles by road from Galway, and $8\frac{1}{2}$ from Moycullen, near Lough Corrib. The road from Galway runs near the sea, that to Moycullen crosses the dreary, stony moorlands of Iar Connaught, as the district of the co. Galway which lies between Lough Corrib and Galway Bay is called.

Oughterard (population, 810), on the picturesque Owenriff river, which drains Loughs Bofin and Agraftord in Iar Connaught, and runs into Lough Corrib after a sinuous course one mile below the town, is a well-known fishing centre. Unfortunately the accommodation for visitors is not of the best, nevertheless comfortable quarters may be had at Murphy's Hotel. There is a fine waterfall or cascade, called the Salmon Leap, on the Owenriff, half-way between the town and the shore of the lake. Oughterard is on the Clifden extension of the Midland Great Western Railway, and is $13\frac{1}{2}$ miles north-west of Galway.

RECESS.

Recess, Connemara, is 163 miles by rail from Dublin, and $36\frac{1}{2}$ miles west-north-west of Galway, on the railway-line which has a terminus at Clifden. The hamlet of Recess stands on the north shore of Glendalough, a lake $1\frac{1}{2}$ miles in length, 69 feet above the sea. The climate is mild and perhaps somewhat relaxing, but the air is of the purest, and the surrounding scenery is of the finest. At the north-eastern extremity of Glendalough—the beautiful Lough Garromin, as it was formerly called—stands the grove-sheltered Recess Hotel, which was opened in May 1898 by the Midland Great Western Railway Company. Quite close to this charming hostelry, which contains all the requirements of a good modern hotel, is a private station, at which all passenger-trains stop to let down intending, and to take up departing, guests. In front of the hotel, the rising ground along the southern shore of Glendalough breaks the force of the strong south-west winds so prevalent in this neighbourhood. From north-west, north, and north-east winds the hotel is completely sheltered by

high ground, which culminates in the Maamturk Mountains to the north-east, in the isolated summit of Lissoughter (1,314 feet) due north of the hotel, and in the majestic peaks of the Twelve Pins (more correctly the Twelve Bens) towards the north-west. The Maamturk or Corcogemore Mountains attain a height of 2,307 feet, while among the "Pins," or "Bens," Bencorr overshadowing the western shore of Lough Inagh, towers to 2,336 feet, and Benbaun (or the "White Mountain") to 2,395 feet.

A splendid panoramic view of the country around Recess may be obtained after a steep climb from the top of Lissoughter Hill, which occupies the angle between the main road from Galway to Clifden and the road up Glen Inagh. The hill-top may be reached in an hour from the Railway Hotel, and the marble quarry on its south-west slope is well worth a visit on the way.

The character of the district about Recess is best described in the words of Professor E. Hull, F.G.S.:—"Perhaps," writes the Professor, "there is no district in Ireland where rock-basins and moraine-dammed loughs are so numerous as in that which lies at the foot of the Twelve Bens of Connemara. . . . Some tracts in this country, such as those lying to the south of Clifden and bordering on Kilkerran Bay, are a perfect network of loughlets, ice-worn bosses of rock, and hummocky mounds of drift. . . . It is impossible by any other theory than that of glacial agency to account for the rock-basins and chains of loughlets by which this country is diversified."

From Recess the railway runs by Ballynahinch, a famous fishing resort, beautifully situated at the foot of Benlettery (1,904 feet), the southernmost of the Twelve Bens of Connemara, which commands a splendid view, to Clifden, 49 miles from Galway and the terminus of the railway.

The Anglers' Hotel at Toombeola near Ballynahinch is a comfortable halting-place for the fisherman, and further on at the head of Cashel Bay is the Zetland Arms Hotel, $4\frac{1}{2}$ miles from Recess station. Comfortable quarters and good and abundant free fishing are the attractions of Cashel.

ROUNDSTONE.

Roundstone (population, 325) is a small seaport, some 5 miles distant from Ballynahinch, and 11 miles south-south-east of Clifden. It is comparatively modern, having been founded by the Martins of Ballynahinch, and built by Alexander Nimmo, the engineer, early in the nineteenth century. The coast scenery is fine, and the bay is studded with islands. Bathing, fishing and boating may be enjoyed, and there is a fair hotel in addition to the accommodation provided by Mrs. E. Mellett at Ivy House. There is a pier and quay at Roundstone, which has a repute for healthiness, and lobsters. Urrisbeg, a hill 987 feet high, rises $1\frac{1}{2}$ miles west of the village, from which the summit may be reached in an hour or less. Dr. Peard, in his delightful book, *A Year of Liberty*, describes the view from Urrisbeg in these words:—

“We have shown the reader ‘bits’ of this fair land (coast of Connemara); but before leaving it, if he desires to obtain a bird’s-eye view of the whole, let him come with me to the summit of Urrisbeg, and see as glorious a panorama as ever was spread out to call forth man’s adoration, and fill his heart with gladness. The rough mountain-path has long been lost, and now we wander on over a carpet of heather spangled with a thousand flowers, from slope to slope, till we gain the highest point. Southward the whole coast lies spread out before us, with its innumerable bays and deep fiords sleeping in the sunshine. . . . Looking northwards towards Urrismore, the eye wanders far and wide over a vast level district nearly uninhabited, almost uncultivated, and dotted with well-nigh three hundred lakes, whilst at our feet blooms in rare luxuriance *Menziesia polifolia*, many a saxifrage, and the deep purple stars of the *Gentiana autumnalis*, with a hundred more common but not less beautiful plants.”

The *Menziesia polifolia*, or St. Dabeoc’s Heath (*Erica Dabeoci*), is unknown in Great Britain, but is common on the heathy wastes of the Asturias and south-western France (Bentham’s *Handbook of the British Flora*). The *Gentiana autumnalis* is the *Gentiana amarella* of Linnæus.

CLIFDEN.

Clifden (population, 911) stands on high ground overlooking Ardbear Bay, a beautiful inlet of the sea. It is a well-to-do modern town, dating back no further than the reign of George IV., when it was founded by Mr. John D'Arcy, who had built Clifden Castle, $1\frac{1}{2}$ miles to the westward, in 1815. Clifden is the terminus of the Connemara extension of the Midland Great Western Railway, and is $175\frac{3}{4}$ miles by rail from Dublin, and $49\frac{1}{4}$ miles by road from Westport. Clifden affords good accommodation for passing guests, and may be described as the key to Connemara and the Western Highlands. The small Owenglin river runs into the bay close to the town, forming a fine cascade in rainy weather, as it falls down its rocky bed parallel to the main street of the town. There is a splendid mixture of mountain and sea air about Clifden. The chief trade is in fish, lobsters being a specialty of the district.

From Clifden to Westport, where the Midland Great Western Railway system is again touched, the visitor takes the public car, visiting *en route* the various points of interest in Connemara—Letterfrack (for Renvyle), Kylemore, Leenane, Delphi, Doolough, and Louisburgh. The cars are timed to run from Leenane, a "half-way" station, to Westport, either by Delphi and Louisburgh, or by the Erriff Valley, in time to catch the afternoon train to Newport, Mallaranny and Achill. The car journey between Clifden and Westport occupies two days, passengers remaining overnight at McKeown's Hotel, Leenane.

The drive from Clifden to Leenane is a splendid one. The road first runs north, passing Streamstown Bay, celebrated for its oysters, and at its mouth Inishturk and Omey Island, with its buried forest. Next Cleggan Head, overlooking the deep-water bay of the same name, is passed, the road traversing a breezy upland moor, the air perfumed with wild flowers. Six miles from Clifden the beautiful fiord, called Ballynakill Bay, is reached. Beyond its deep blue waters to the northward the rocky mass of Renvyle Hill rises to the height of 1,172 feet. Eastward the bay runs up to Letterfrack, charmingly situated almost at the foot of Bengob or Diamond Mountain (1,460 feet), the westernmost elevation of Bunnabeola, or the Twelve Bens. It is named

Diamond Mountain from the quartz crystals which abound in its rocks. The view towards the north-west is limited by the large island of Inishbofin, some 3 miles long and 2 miles broad, and with 874 inhabitants.

LETTERFRACK.

Letterfrack (population, 294) is a neat village beautifully situated at the head of Barnaderg Bay, and not far from the fine pass of Kylemore. It owes its origin to the philanthropy of Mr. Ellis, a member of the Society of Friends, who founded a colony here shortly after the famine of 1846-47, and turned what was little better than a wilderness into a pretty and thriving village. The mildness of the climate is evidenced by the luxuriant growth of fuschia in hedges by the roadside. There is comfortable hotel accommodation at Casson's Hotel, and good and safe bathing may be had in Barnaderg Bay, an inlet of Ballynakill Harbour or Bay.

Renvyle House Hotel is 5 miles by road north-west of Letterfrack. It was the family seat of the Blake family, but since 1888 it has been one of the best and most popular hotels in the west of Ireland, under the personal management of Mrs. Blake. The house stands on the edge of some rocky cliffs near the shore, which is of fine white sand, affording facilities for sea-bathing. Fishing and shooting may also be enjoyed—seals being included amongst the "game." There are also golf-links. It has been well said that Renvyle House "combines" the comforts of a family country-house and the freedom of a hotel. A lady lately described this delightful place as a very paradise for children.

Eight miles east of Renvyle House is the Pass of Salruck, between Loughs Fee and Muck and Little Killary Bay. The views from the Pass are beautiful. The neighbouring mountains are covered with ferns and heaths, including *Menziesia polifolia* and the white heath.

The route from Letterfrack to Leenane lies through the Pass of Kylemore (Celtic, *Coill-mor*, Great wood), which is one of the gems of Connemara. On the north the glen is overhung by the steep slopes of Doaghruie (1,736 feet), covered with shrubs and dense underwood. On the south are the Twelve Bens—Adragoole (1,577 feet) Benbrack (1,922 feet) Muckanaght (2,153 feet),

and Benbaun, or the White Mountain (2,395 feet), rising one above the other. Indeed, from no other place can the summits of the Bunnabeola chain be seen to such advantage. The road passes through a portion of the demesne of Kylemore Castle, formerly the seat of Mr. Mitchell Hardy, and further on, near Kylemore House, Lord Ardilaun's shooting-box. Having crossed a large moor at the summit of the pass, the road descends towards the southern shore of the magnificent fiord called Killary Harbour. This land-locked sheet of salt-water extends 9 miles inland between lofty mountains, the towering mass of Muilrea guarding the mouth of the fiord, and rising abruptly from the water's edge to the height of 2,688 feet. Behind Muilrea is Benbury, 2,610 feet high. Further inland, on the east side of the Vale of Delphi, the lofty Bengorm (2,303 feet) overshadows the fiord. Leenane Mountain (1,404 feet), and behind it another mountain (2,052 feet), rise from the southern shore, while the Devil's Mother (2,131 feet) overlooks the hamlet of Aasleagh at the head of the Killaries, where the Erriff river falls into the sea by a series of cascades which act as a salmon leap. Professor Hull says that along the southern shore of Killary Harbour the glacial phenomena are very striking. The rocks are intensely glaciated, scored with groovings pointed down the valley, while masses of moraine matter with high boulders are strewn along the shore. The mountains of the Killaries are composed of rocks belonging to the Upper Silurian measures.

LEENANE.

Leenane is a tiny hamlet at the head of the great Killary fiord, which separates Galway from Mayo. There is a well-appointed hotel (McKeown's), which is the most convenient centre from which to visit the fine scenery of the Western Highlands. The hotel is close to the water's edge, and is sheltered on nearly all sides by lofty mountains. It is in the heart of a fishing and shooting district of the first order. The proprietor has some free fishing and a large tract of free shooting; also about 10,000 acres of grouse-shooting to let. There is good sea-bathing within a few yards of the hotel. White trout and salmon-fishing may be obtained on Townyard Lake, which is supplied from the Erriff

river, the fish ascending by the Owenduff, a tributary of the Erriff.

Of the two routes from Leenane to Westport by far the more interesting, but much the longer, is that by Delphi and Doolough to Louisburgh, and thence along the foot of Croagh Patrick and the southern shore of Clew Bay. The drive from Aasleagh, where the Erriff river is crossed at the head of Killary Harbour, is by a road constructed by the Congested Districts Board. If preferred, a boat can be taken from Leenane to Bundorragha, a village at the lower end of the wild mountainous Pass of Delphi. The Doolough (Black Lake), which the road skirts at the head of the pass, is overshadowed by splendid mountains; on the south-west side, Benbury (2,610 feet) and Benlugmore (2,618 feet); on the north-east side, Glennumera (2,474 feet) and Sheeffry (2,504 feet).

COUNTY MAYO.

LOUISBURGH.

Louisburgh, co. Mayo (population, 400), is a small town on the Bunowen river, about a mile from the southern shore of Clew Bay, and 2 miles south-west of a wooded rocky promontory, called Old Head, in the vicinity of which there is good sea-bathing. For miles round Louisburgh there are the remains of ancient forests, the stumps of numerous pine and fir and other trees projecting from the surface of the bog. There is nothing to detain the visitor in Louisburgh; but the views from it of Clare Island, Clew Bay, and Croagh Patrick are worth seeing. Along the north side of Clew Bay also there is a wonderful panorama of mountains from Croaghaun in Achill Island to Nephin near Ballina.

Clare Island requires a few descriptive words, adding as it does so much to the scenic attractions of the health resorts on the shores of Clew Bay. It lies right in the centre of the opening into this vast and beautiful inlet, between Achill Island and the Curraun Peninsula on the north, and the district of Murrisk on the south. The island is $4\frac{1}{2}$ miles long, by 2 miles broad. Its area is 3,950 acres, supporting a population in 1891 of 587 souls. The highest point is Knockmore, 1,520 feet above the

sea. At the north-east point stands a lighthouse at an elevation of 487 feet, lat. $53^{\circ} 49' 30''$ N.; long. $9^{\circ} 53' 30''$ W. The inhabitants are engaged in agriculture, kelp-burning, and sea-fishing. They are a healthy and a hardy race. Clare Island was the home of the famous Grace O'Malley, or Grana Uaile, Queen of the Isles, who lived in the reign of Elizabeth, to whom she once paid a visit.

Croagh Patrick also should not be passed over in silence. This remarkable conical peak, called in Irish *Croagh Patrick*, the Reek of St. Patrick, is really the summit (2,510 feet above the sea) of an elongated granite and quartz range, which stretches east and west along the southern shore of Clew Bay for some miles. The bold quartzite main peak commands a noble view, and is in its turn a conspicuous landmark both at sea and on shore for very many miles. Lovers of folk-lore will be interested in the steep precipice on the south side of the mountain to which the name *Lug-na-Narríh*, the *Hollow of the Demons*, is given because into it St. Patrick is fabled to have driven all the snakes, toads, adders, and other noisome things in Ireland. Croagh Patrick is also a sacred hill, to which a solemn pilgrimage (or "Pattern") is made on St. Patrick's Day, March the 17th, in each year. At the foot of the mountain nestles the hamlet of Murrisk, close to a small and sheltered bay. It is 6 miles west of Westport, and close by are the ruins of the ancient Abbey of Murrisk, founded by the O'Malleys.

WESTPORT.

Westport, the most populous town in Mayo, is a prosperous market town and a seaport situated at the south-east corner of Clew Bay. The population was 4,070 in 1891. The town occupies a narrow valley, watered by a pretty mountain stream, the Carrowbeg, which runs through the centre of it, and thence into the sea through the well-wooded demesne of the Marquis of Sligo. There is sea-bathing along the sea-front, which is rather more than a mile distant from the town. Here there are villas and cottages, in which visitors are accommodated during the bathing season. A feature in Westport is the Mall, which is planted with lime-trees, and along which the Carrowbeg river runs. A pleasant walk or

drive is through Lord Sligo's demesne from the town to Westport Quay, a distance of some 2 miles. Further afield, at 5 miles inland towards east-south-east, is the Gulf of Aille, a series of subterranean caves through which the Aille rivulet flows.

A glance at the map will show what a remarkable sheet of water receives the name of Clew Bay. It is a vast quadrilateral, 15 miles long by 8 wide. In the centre of the western opening stands Clare Island, a bulwark against the violence of the Atlantic. The eastern end of the bay is studded with countless islands to a distance of some 4 miles from the shore. Along the front of these a curious natural breakwater stretches for a distance of $1\frac{1}{2}$ miles from the shore near Murrisk northwards. This bar or breakwater slopes seaward, the gradient in some places being 1 to 30. It is formed of boulders. "Though natural," says Mr. Bald, "it is perhaps one of the most remarkable hydraulic works that exist in Europe, its mass being greater than that of the breakwater at Plymouth or that of Cherbourg."

NEWPORT.

Newport (population, 598) is a small seaport at the north-east corner of Clew Bay, $7\frac{3}{4}$ miles north of Westport, with which it is connected by the Achill branch of the Midland Great Western Railway. Its chief attraction is white-trout-fishing in Lough Beltra (6 miles north-east), from which the Newport river flows. In Furnace Lough and Lough Feeagh, towards the north-west, is the source of the Burrishoole river, at the mouth of which are the ruins of Burrishoole Abbey, founded in 1486. Lough Feeagh lies in the hollow between Bengorm (1,912 feet) on the west, and Buckoogh (1,935 feet) on the east, so that the scenery is very fine and wild.

From Westport to Newport along the eastern shore of Clew Bay the geological formation is the carboniferous limestone. Just before Newport is reached there is an abrupt transition to the Upper Silurian. Beyond Newport towards the west there is a narrow band of Old Red Sandstone running parallel with the Upper Silurian measures, until at Mallaranny both give place to metamorphic rocks of Lower Silurian age, crystalline and abounding in quartzite.

MALLARANNY.

Mallaranny is a hamlet, beautifully situated near an isthmus which joins the Curraun Peninsula to the mainland, separating Clew Bay on the south from Bellacragher Bay on the north. It is 18½ miles by rail from Westport, and 179½ miles from Dublin. The ground slopes steeply to the water's edge at Trawoughter Strand, running out from the sands of which is a stone causeway or pier, which serves the double purpose of a landing-place and of a promenade. From the west Mallaranny is protected by the Curraun Highlands, rising to 1,784 feet. From the north and north-east it is sheltered by Claggan Mountain (1,256 feet). Adjoining the railway-station are the extensive grounds of the Railway Hotel, which are entered from the platform. The hotel is a large, modern, first-class hostelry, standing on the southern slope of the isthmus about 100 feet above the sea, and commanding a splendid prospect over Clew Bay. Through a hanging coppice, shaded paths lead down from the hotel to the strand below. Giant fuchsias everywhere abound, and testify to the mild and genial climate of the place. In the grounds on the west side of the hotel rises a round knoll, the slopes of which have been skilfully planted on all sides, and mapped out with winding paths, furnished with rustic seats at short intervals. From this knoll the views are beautiful. Southward, the eye traverses the whole southern shore of Clew Bay from Westport past the broad shoulders and towering peak of Croagh Patrick to Louisburgh with its background of the Killary mountains and Mulreea; northward, Blacksod Bay, the wilds of Ballycroy and Erris; in the immediate foreground Bellacragher Bay; and lastly the lofty summits of the North Mayo or Maam-Thomas mountains, with Nephin, 2,646 feet, loftiest of all, far away towards the east-north-east. The proximity of Blacksod Bay, with its inlet Bellacragher Bay to the north-west, prevents the occurrence of excessive heat in summer or of excessive cold in winter. Whenever the sun's rays are exceptionally powerful, a cool sea breeze blows in, either from Clew Bay or from Blacksod Bay. A correspondent of Dr. Quinlan, who wrote an interesting paper on "Mallaranny as a Winter Health Resort" in the *Dublin Journal of Medical Science* for March 1899 (vol. cvii. p. 177), thus describes the climate:—

"During periods of summer heats we have fogs which during the early mornings obscure and envelop the summits of the neighbouring mountains, but as the day advances they vanish, and leave a clear atmosphere; with this exception we have clear bright skies. Our rainfall comes in heavy showers, which pass off and leave a clear sky; the ground dries rapidly after rain: we are not troubled with drizzle or Scotch mist, and murky days are most exceptional." Mr. Myles, C.E., engineer to the Midland Great Western Railway, states that the annual rainfall is from 40 to 60 inches, but Dr. Quinlan points out that a comparatively heavy rainfall such as this, when the rain comes down in heavy showers, is more favourable to the invalid than a lighter one assuming the form of long-continued drizzle and mist. There is no fully-equipped meteorological station as yet at Mallaranny: but the following table (see p. 519) includes the results obtained at the neighbouring station of Belmullet, and may fairly be accepted as representing the climatic conditions prevailing at and near this favoured spot, to which the general testimony is borne that "Mallaranny is the sunniest place on the coast."

In Dr. Quinlan's opinion Mallaranny "offers a great field for the winter treatment of the early stages of pulmonary consumption, on the modern open-air plan. For chronic bronchitis and pulmonary diseases generally, the mild equable climate presents great opportunities; for the invalid who is able to go about, and who can take a fair amount of exercise, it is very suitable, and for such people there is a variety of walking, driving, or cycling runs through fine scenery on quartzite roads of easy gradient, which are always hard and free from mud, like the well-known Connemara roads. For those who are simply overdone with hard work Mallaranny offers great advantages: and for 'week-ends' it is very suitable for the healthy recreation of the busy."

The flora of Mallaranny is almost sub-tropical. In addition to luxuriant fuchsias, oleanders and other sub-tropical plants abound. Mediterranean heath too flourishes, while the royal fern (*Osmunda regalis*) is indigenous.

From Mallaranny the railway runs round the northern portion of Curraun Peninsula in a semi-circle to Achill Sound. The line is laid over miles of bog, and at first descends rapidly to sea-level along the western shore of Bellacragher Bay. Achill Sound

connects Blacksod Bay with Clew Bay, and through the narrow channel, 6 miles in length, the tidal waters rush to and fro in an impetuous stream. At each side of the water-way near the railway-terminus there are a few houses and cottages, and these now go by the name of Achill Sound. The Sound is now bridged over by a causeway constructed in 1888, with the generous help of Mr. J. G. Porter, of Belle Isle, co. Fermanagh. Through an iron swivel-bridge road traffic is carried on between the island and the mainland. Ship traffic is maintained by opening the swivel-bridge at "dead water" if required.

BELMULLET, CO. MAYO, LAT. 54° 13' N. ; LONG. 9° 59' W.

40 FEET ABOVE SEA-LEVEL.

MONTH.	Barometer at 8 a.m. Means 1871-95.	TEMPERATURE OF THE AIR, 1871-1895.				Rainfall Means 1866-1895.
		Dry Bulb 8 a.m.	Wet Bulb 8 a.m.	Daily Maxi- mum.	Daily Minimum.	
January	29·830	42·3	41·0	46·4	38·7	5·48
February	29·870	42·3	40·7	47·2	38·8	4·20
March	29·882	43·2	41·4	48·4	39·3	3·80
April	29·863	46·5	44·3	52·2	42·7	2·48
May	29·941	51·0	48·2	55·7	46·3	2·83
June	29·953	56·2	53·2	60·8	51·4	2·85
July	29·889	57·5	54·9	62·2	53·8	3·59
August	29·867	57·8	55·2	62·5	54·1	4·62
September	29·904	55·1	52·7	59·6	51·6	4·26
October	29·846	49·4	46·4	53·9	46·0	5·18
November	29·799	45·3	43·3	49·4	41·5	5·92
December	29·822	42·8	40·9	46·9	39·0	5·36
Means	29·872	49·1	46·9	53·8	45·3	50·57
				49·6		

ACHILL ISLAND.

Achill Island, roughly triangular, is about 15 miles long from Achill Head to the Sound, and about 12 miles broad from Achill Beg Island, off the south coast, to Ridge Point in the extreme north. The coast-line is about 80 miles. Its area is 36,248 acres, and its population was, in 1891, 4,677. Achill is the largest island off the Irish coast. It is for the most part covered with hummocky bogs or wet moors clothed with dark heather. The whole island is hilly, and in the north Slievemore rises to 2,204 feet, while the western shore is formed by the stupendous cliffs of Croaghaun, which tower 2,192 feet above the sea. Other fine cliffs are Doogea Head (800 feet almost sheer), and the cliffs of Menaun forming the buttresses of a hill 1,530 feet high.

Achill is almost entirely composed of metamorphic rocks of the Lower Silurian age. "The most ancient of rock-groups known as Archean, is found on the extreme west coast of Achill, overlain inconformably by the newer schists, with a conglomerate base."¹ As was to be expected from the nature of its rocks, there is no native wood in Achill. Near the Sound there is however a large and healthy plantation, chiefly of Scotch fir, in the demesne of Mrs. Pike. Near the dwelling-house also rhododendrons grow in rare luxuriance.

"The climate of Achill," writes Dr. Edgar Flinn,² "offers particular advantages to the invalid community. It has a fine bracing and exhilarating atmosphere, and the bathing facilities are remarkably good." The climatological table for Belmullet (p. 519) fairly represents the facts as regards the temperature, rainfall and atmospheric pressure actually experienced in Achill. Belmullet is about 15 miles almost due north of Doogort, at the northern extremity of Blacksod Bay.

The eastern shore of Blacksod Bay forms the district known as Ballycroy, a portion of the barony of Erris, co. Mayo. In an interesting account of the ethnography of this district, read before the Royal Irish Academy, May 11, 1896,³ the author, Dr. Charles R. Browne, writes thus:—

¹ *Ireland from Sea to Sea*, p. 104.

² *Ireland: its Health-Resorts and Watering-Places*.

³ *Proc. R.I.A.*, 3rd Series, vol. iv. no. 1.

“The climate is very mild, there being but little frost or snow in winter; but, as might be expected from the situation of the locality, it is very moist, rains being both heavy and frequent, and storms of great violence often sweeping over the region from the westward. Vegetation flourishes well, owing to the mildness of the climate, a good example of which is the fact that palms and other exotics grow well in the open air in the grounds of General Clive at Claggan, in the southern part of the district. Trees of various kinds flourish in the valleys, and wherever sheltered from the prevailing winds. In the valleys among the mountains, the red deer used at one time to be met with in some numbers, but within the last forty years they have become quite extinct. Wild-fowl, in great numbers, visit the lakes and coast-line in winter-time, among them wild swans, which principally frequent Lough Fahey, near the coast. The number of the smaller wild animals is very considerable.”

In “*Maga*” the Poet Laureate says of Achill:—“A more perfect place of holiday resort it would not be possible to imagine. There are fine yellow sands, where children may make their mimic dykes and fortresses: mountains of moderate height . . . for the young and vigorous to ascend; easy hill foot-tracks for the weaker brethren; fishing either in smooth or in rolling water for those who love the indolent rocking, or the rough rise and fall of the sea; precipitous and fretted cliffs carved with the likeness of some time-eaten Gothic fane by the architectonic ocean: rides, drives and walks amid the finest scenery of the kingdom.”

Among the many interesting features in Achill are Keel Strand, a magnificent stretch of sandy beach, running in a curve of nearly 3 miles from the cathedral rocks of Menaun to the old and quaint village of Keel; this village itself, and 2 miles further westward the fishing village of Dooagh, with its primeval dwellings: the sheltered Keem Bay, where there is a quarry of “Irish amethysts,” that is, mauve-coloured quartz crystals; Captain Boycott’s former residence on the eastern slopes of Croaghaun; Lough Acorrymore, the only mountain tarn of considerable size in Achill; Keel Lake: the seal-caves near Slievemore; and the Menaun and Dooega cliffs already mentioned.

DOOGORT.

Doogort, commonly called the "Settlement," is the chief stopping-place of visitors to Achill. The neat and interesting little village or hamlet is finely situated at the very foot of Slievemore, the highest mountain in Achill (2,204 feet). It stands on a slope near a small bay on the northern shore of the island. On the sands lining this bay there is excellent sea-bathing, and the famous "seal-caves" can be visited by boat in calm weather. They are 2 miles away on the north-western side of the Slievemore.

The Slievemore Hotel, kept by Mr. J. R. Sheridan, is a favourite house. The landlord is a many-sided man, and a noted personality in Achill. The Dispensary Medical Officer and Medical Officer of Health is Dr. Thos. Henry Croly, who reports as follows on the health of Achill Island, and especially of Doogort:—

"*Anæmia* and *debility* are scarcely ever seen among natives. Visitors say that they recover quickly from these maladies, and are braced up immensely by a change to Achill. *Scrophula* and *tuberculous diseases* are an 'unknown quantity.' *Phthisis* is rare among the natives." Dr. Croly considers the air too moist in winter, but excellent in summer and autumn for the treatment of consumption. A good many suffer in winter and spring from *catarrh*, *bronchitis*, and *pneumonia*. *Pleurisy* is not as frequent as diseases of the lungs themselves. There are very few cases of *asthma*, and asthmatic patients declare themselves to be much benefited by a change to Achill. There is a fair proportion of cases of *acute renal dropsy*, but *chronic albuminuria*, with or without granular kidney, is very rare. *Calculus* and *gravel* are unknown amongst the natives, and visitors affected with these troubles seem to derive benefit. Of *rheumatoid cases* there is a fair proportion to the population. Dr. Croly would recommend Achill in *neuralgia*, but not in rheumatism under its various forms. *Diseases of the skin* are unknown, unless when brought from outside. There are no *malarial affections*. Very few cases of *typhoid fever* occur. *Dysentery* is not prevalent. Three epidemics of *scarlet fever* have occurred within the past twenty years. *Diphtheria* is unknown in the lower portion of the island. *Endemic sore throat* is fairly prevalent. The common causes of death are chronic bronchitis, chronic pneumonia, old age and debility. A great many of the

population attain ages ranging from 80 to 90. The system of drainage adopted—into lakes or streams through open drains—is not to be commended, seeing that the water supply is derived from mountain-streams, wells, and in a few instances lakes. In Doogort however there is a plentiful supply of splendid spring-water. This place also is chiefly drained through closed pipe-sewers.

According to Dr. Croly's observations, Doogort enjoys a mild climate. Frost and snow are rare. South-west winds prevail. There is an average amount of sunshine. Rainfall and fog are above average in winter and spring. Dr. Croly thus tersely sums up the characters of the climate in the different seasons—Spring, rainy; summer, rainy, but with spells of splendid weather; autumn, generally fine; winter, wind and rain. Visitors should select the early summer or autumn for their stay in Achill.

BELMULLET.

Belmullet¹ (population, 652) is built on a strip of land, only 400 yards in width, which separates Broadhaven on the north-east from Blacksod Bay on the south. These two capacious and landlocked natural harbours are now connected by a canal permitting vessels to pass through without the risks of weathering Erris Head and the Mullet, as the long promontory or peninsula west of Belmullet is called. The town is well built, and possesses two inns and very fair accommodation for visitors. Its fortunes are handicapped by its inaccessibility. There are two routes from Belmullet to Killala and Ballina—the longer or northern road is nearer the coast (49 miles), the shorter or southern is by Bangor, a little inland village, and Crossmolina near Lough Conn, and Nephin (2,646 feet), (40 miles).

The scenery of the north coast of Mayo, from Erris Head in the west to Kilcummin Head at the mouth of Killala Bay, is in places very fine. Benwee Head, at the north-eastern extremity of Broad Haven, is 829 feet high, and commands a splendid view both northwards and southwards. A mile and a half north of the Head, the seven precipitous rocks called the Stags of Broad Haven, tower above the sea to a height of some 300 feet. East of Benwee Head is a beautiful little harbour called Portacloy. Here and

¹ For meteorological data see p. 519.

elsewhere along this coast are some remarkable caves and cliffs. At Belderg and Ballycastle there is some sea-bathing. Kilcummin Head was the scene of the landing of the French under General Humbert, on August 22, 1798.

Killala (population, 558) is 8 miles north by west of Ballina, with which it is connected by an extension of the Midland Great Western Railway. Its former trade has been diverted in great measure to Ballina, but it is interesting because of its round tower and the ruins of Moyne Abbey, $1\frac{1}{2}$ miles to the southward on the banks of the river Moy opposite to Bartragh Island. The abbey was founded in 1460. Roserk or Rosserick Abbey stands near the water's edge, some 2 miles further south.

BALLINA.

Ballina (population in 1901, 4,499) is built at the head of the tideway on the west bank of the Moy, at a distance of $166\frac{3}{4}$ miles by rail from Dublin. It is a busy and thriving market-town and seaport—the improved navigation of the Moy having greatly contributed to its prosperity. The fishing in the Moy is justly renowned, both salmon and trout being plentiful. There are very fair hotels in Ballina, the neighbourhood of which is in many directions attractive. The river Moy forms the boundary between the counties Mayo and Sligo. Two handsome bridges span the river at Ballina, leading from the town to its suburb Ardarae, on the Sligo side.

COUNTY SLIGO.

ENNISCRONE.

Enniscrone (or **Inishcrone**) is a pleasant little watering-place, $7\frac{1}{2}$ miles north-east of Ballina, on the east side of Killala Bay. Its population is 331, but in summer there are many visitors. A long ridge of sand-dunes stretches westward for $1\frac{1}{2}$ miles to the mouth of the Moy opposite Bartragh Island. In front of the sand-hills is a magnificent sandy beach. Another interesting feature is the geological formation of what are locally called the "serpent rocks." Gigantic slabs of carboniferous limestone form a series of rising platforms along the shore, and in these are

embedded vast numbers of fossils of fish resembling stripped cabbage-stalks more closely than anything else. In places, there are collections of small fish or fry of the same species, as if some stupendous convulsion of nature had overwhelmed the district, and turned the fish to stone.

Dr. H. M. Scott, the local Dispensary Medical Officer and Medical Officer of Health, has favoured me with the following report:—

“The district surrounding Enniscrone is open and hilly. It is exposed to west and south-west winds, but is sheltered from the east by high grounds culminating in the Ox Mountains, which attain an altitude of nearly 1,800 feet at a distance of some 8 miles. The surface of the district is uneven and hilly. The soil is of a dry, sandy nature. The elevation ranges from sea-level to 300 or 400 feet above it. There are very few trees near Enniscrone, but they become numerous about a mile inland. Vegetation is a month earlier than in almost any other portion of the neighbouring district. Owing to its proximity to the Atlantic there is very little frost, snow or ice. A heavy fall of snow may occur inland, Enniscrone escaping. The climate is fairly dry, and free from extremes of temperature. Westerly winds prevail; there is a large amount of sunshine, and fog is very rare. As to the seasons, summer and autumn are cool, winter and spring are very mild, with the exception of some harsh winds in March.

“There is but little difficulty as to drainage, owing to the steepness of the gradients and the sandy nature of the soil. The water supply is derived by gravitation from limestone springs. Residence at Enniscrone proves beneficial to convalescents after typhoid fever and pneumonia, and in debility, dyspepsia, chronic rheumatism, and all diseases requiring an exhilarating atmosphere and pure, fresh air.

“‘Old age’ is a frequently assigned cause of death amongst recently-registered deaths in the dispensary district; five of the deceased had reached ages varying from 76 to 90 years.

“The district is remarkably healthy, and free from epidemic or endemic diseases; also from affections of the skin. Pulmonary phthisis, pneumonia, and pleurisy are all rare. So are catarrh and bronchitis, except in the early spring.” Dr. Scott considers that the air is too strong and bracing for asthmatic visitors; all others do well, when recovering from illness, at this really fine watering-place.

EASKY.

Easky (population, 330) is a small village near the mouth of the river of the same name, which flows from Lough Easky in the Ox Mountains through a valley strewn with granite boulders. It is a fine, bracing seaside resort, but rather out of the way. The coast-road from Ballina to Sligo runs through both Enniscrone and Easky to Dromore West, but the direct road traverses a long stretch of somewhat bleak upland for many miles.

Dromore West is a pretty village on the Dunneill Burn, which flows headlong from the neighbouring Ox Mountains. The village is slightly over a mile from the sea. The surrounding country is both picturesque and well cultivated, at least to the eastward in the direction of Sligo, the sea forming a pleasing feature in the landscape. The coach-road passes through the hamlets of Skreen and Beltra, and the beautifully-situated village of Ballysadare, $4\frac{1}{2}$ miles south of Sligo, at the head of Ballysadare Bay. The Irish name, *Baile-casa-dara*, means the *Cataract of the Oak*, and its aptness will be at once seen when the cascades come into view by which the river reaches the sea-level from the high ground on which Ballysadare stands. Near Collooney, 2 miles south of Ballysadare, is Markree Castle, the seat of the Cooper family, where there is a fully-equipped Second Order Meteorological Station.

SLIGO.

Sligo (population in 1901, 10,862) is the largest and busiest seaport in the north-west of Ireland. It stands (lat. $54^{\circ} 17' N.$; long. $8^{\circ} 26' W.$) in the midst of beautiful scenery, near the mouth of the river Garrogue, which flows from Lough Gill, one of the loveliest of the Irish lakes, 5 miles in length and from 1 to $1\frac{1}{2}$ miles in breadth, and studded with numerous well-wooded islands. The town derives its name from the nature of its river-bed, the Celtic *Sligearh* meaning shelly river. There are many fine public buildings, and Sligo Abbey, founded by Maurice FitzGerald, Earl of Kildare, in 1252, for the Dominicans, testifies to the antiquity of the place. But it is to its charming surroundings that Sligo more particularly owes its right to be mentioned here.

Set in the midst of a richly-wooded plain, Sligo presents a rare combination of mountain, lake, river and coast scenery. Due north rise the magnificent cliffs and table-land of Benbulbin (1,712 feet), and the still higher summit of Truskmore (2,113 feet). To the south-west the gigantic sepulchral mound of Knocknarea—the Hill of the Queen—overshadows Ballysadare Bay. On the top of this curious isolated circular limestone hill, 1,078 feet in height, and resembling a huge Twelfth-Night-cake, is a mighty cairn, the fabled tomb of Meav (the Queen Mab of English legendary lore), Queen of Connaught in the first century of the Christian era. The cairn is formed of a pyramid of loose stones, 590 feet in circumference, 80 feet in its widest diameter, and 34 feet high. It is surrounded by massive megalithic monuments. Between Knocknarea and Ballysadare is Carrowmore, famous for its ancient stone monuments—cromlechs and stone circles. These archæological remains are said to be the graves of the slain in a great battle fought on the Plains of Moytura in early Irish history.

Besides Lough Gill, Glencar deserves mention for its beauty. It is a mountain valley, 6 miles north-east of Sligo, in the bosom of which reposes an exquisite lake, Lough-na-Glena by name. A mountain torrent descends into this lough on the north side by a series of waterfalls through a precipitous yet beautifully-wooded glen. As one enters Glencar from the Sligo road, by a strange optical delusion both the lake and the river issuing from it appear to be far below the level of the spectator and of the entire opening of the valley.

The climate of Sligo is changeable, mild and rainy. Yet the ground dries quickly, owing to the limestone formation and the prevalence of high westerly winds. The inhabitants enjoy good health and are long-lived. In the north of the county the soil is mossy and sandy, with an admixture of a gravelly loam. The plain of Sligo is composed of a deep, rich loam. The coast-line is irregular, rocky, and dangerous to navigation, except in the sheltered reaches of Sligo Bay.

ROSSES POINT.

Rosses Point, the special watering-place of Sligo, is distant 5 miles to the north-west. It is a neat fishing village, situated

at the western extremity of a promontory between Drumcliff Bay on the north and Sligo Bay on the south, which is called "The Rosses." The village faces south, and commands splendid views of Sligo Bay, Knocknarea, and the Ox Mountains in the far distance. There is good hotel accommodation, and the lodging-houses, though small, are neat and clean. West of the village are short golf-links and a club-house. There is excellent deep-sea-bathing at the extreme west of the promontory of the Rosses. Steamers run from the quay at Sligo to the pier at Rosses Point. The drive by road is very pretty, but it is to be regretted that there is no railroad accommodation. An extension of the Midland Great Western Railway from Sligo would benefit the trade of that town, and greatly develop Rosses Point, which has a future before it as a health resort and bathing-place.

Strandhill is a little hamlet at the foot of Knocknarea to the north-west, and opposite to Rosses Point. It is sheltered by Coney Island, which protects Sligo Bay from the open sea. In front of Strandhill is a fine stretch of sandy beach, called Commeen Strand.

From Sligo northwards and north-eastwards to Bundoran is a charming drive of 22 miles. The road runs on high ground midway between the sea and the mountains, and commands fine views on both sides. Five miles from Sligo the coach passes Drumcliff church and village, near which are an old Irish cross, the stump of a round tower, and a cromlech. To the left of Drumcliff are the fishing villages of Carney and Raghly, with the demesne of Lissadill, the beautiful seat of Sir Henry W. Gore-Booth, Bart. Lissadill oysters are renowned for their excellence. Near Raghly are the so-called Pigeon-Holes, openings into subterranean caverns, hollowed out by the waves, which spout through them in rough weather, producing the effect of an intermittent natural fountain.

At Streedagh Point, near the village of Grange (population, 125), three large vessels of the Spanish Armada were totally wrecked in the autumn of 1588. This will give some idea of the dangerous nature of the coast.

Fourteen miles from Sligo, the neat little village of Clifflony (population, 101) is passed. The hamlet and surrounding district formed part of the Irish property of the late Viscount Palmerston, and are now in the possession of the Right Hon. A. Evelyn

Melbourne Ashley, of Classybaun Castle, Cliffony. Both Lord Palmerston and Mr. Ashley have done wonders for the district. Lord Palmerston, in 1842, constructed the harbour of Classybaun (this Celtic name meaning the "White Harbour") at a cost of over £20,000. He also caused the sand-hills of the vicinity to be planted with sea matweed or maram (*Ammophila arundinacea*), which bound the sand together, and prevented it drifting. The small fishing village of Classybaun has of late years expanded into the watering-place of—

MULLAGHMORE.

Mullaghmore. This finely-situated seaside resort consists of a long line of villas, built along the ridges of a headland running north and south, half-a-mile to the westward of the fishing village already mentioned. At its southern end this headland is 118 feet in height above the sea. On it stands Mr. Ashley's residence, Classybaun Castle. The air is splendid, there is good sea-bathing, and the sea-fishing is excellent. Nothing can exceed the bracing character of the sea-air along the shores of Donegal Bay from Mullaghmore, by Bundoran and Donegal to Dunkineely, by Killybegs and Malin Bay.

COUNTY FERMANAGH.

ROSSCLARE SANATORIUM.

Rossclare Sanatorium.—In 1898, at the instance and expense of Mr. Cooney, a merchant of Enniskillen, a sanatorium for the treatment of consumption, after the plan adopted at Nordrach, in the Black Forest, was opened at Rossclare, Killadeas, co. Fermanagh. Rossclare Sanatorium is 7 miles from Irvinestown, and 4 from Ballinamallard—all stations on the Great Northern (Ireland) Railway. It stands on a hill overlooking Lough Erne, and commands one of the finest views in Ireland. The house is strongly and substantially built, with bright and airy rooms, and is capable of accommodating twenty patients at a cost per patient of four guineas a week, including board, drugs, medical attendance, fire and light.

Dr. Peverell Smythe Hichens, M.A., M.B., Oxon., at the time

resident physician, wrote to me under date July 14, 1900, as follows:—

“I have not yet been here long enough to be able to give you any statistics on the subject of the climate of this place. Since I was myself a patient at Nordrach last year, my own views as to the climatic treatment of consumption have changed very considerably. The climate of Nordrach is very much like that of the British Isles: there is an abundance of rain and a good deal of mist and fog. Being in a deep valley there is not as a rule much wind, and it is somewhat hotter in summer and colder in winter, like most continental climates, but otherwise there is nothing peculiar about it. It is now my belief that consumption can be successfully treated in any good pure country air, such as we have at Rossclare. I did not myself select Rossclare for the purpose: it was chosen by Mr. Cooney, because there was then ready to his hand a well-built, airy house, which was unoccupied. Rossclare was built for a hotel, and stands on a promontory which runs out into the Lower Lough Erne. I find by an aneroid barometer that it is 125 feet above the lake, and I believe the level of the lake is about 160 feet above the sea. The house, which occupies two sides of a square, faces south-east and south-west. From its lofty situation it is exposed to winds, but there are sheltered woods under the house along the lake, and extensive woods near by, where the patients can get an abundance of sheltered walks; and there is a large shelter with movable shutters in the garden.

“The geological formation is limestone, and dries readily after rain. Judging from the nature of the vegetation, and the amount of the rainfall recorded in the three months I have been here, I do not think the annual fall can be anything excessive: probably it is a little over 30 inches. We are not amongst the mountains, but look at them from a distance. Rossclare is on the northern shore of the lake.

“I carry out the Nordrach system here strictly, but give more digestible food and proper nursing. An ordinary patient, who still has a good deal of weight to gain, has three pints of milk a day, three and a half ounces of butter, besides a good deal in the cooking, and only three meals a day—breakfast at a quarter-past eight, dinner at one, and supper at seven. They can have afternoon tea if they like. They eat the butter at breakfast and supper. I

modify the diet to a certain extent for those with very weak digestions. At present it is too early for me to give you any statistics as to results, and I have not yet had many patients, but I think they are decidedly encouraging."

COUNTY DONEGAL.

BUNDORAN.

Bundoran (population, 764) is one of the most popular watering-places and seaside resorts on the west coast of Ireland. It is finely situated on cliffs of moderate height, along the shore of a small bay or fiord running into the land from Donegal Bay. To the strong west and north-west winds, which prevail along this coast, Bundoran is fully exposed, an almost complete absence of trees depriving the town of shelter and shade alike. Owing to the force of the wind and the geological formation, the ground dries quickly after rain, and the dust is then troublesome. The formation is the carboniferous limestone. It has been hollowed out into extraordinary rock-basins at Bundoran, in which salt-water baths may be taken at low water. The limestone slabs abound in fossils. On the cliffs north-west of the town stands the Great Northern Railway Hotel, a substantial concrete building in the Elizabethan style, commanding a fine view of the Leitrim and Sligo mountains, and of the bay. Surrounding the hotel is an excellent 9-hole golf-links. To the west of the hotel runs a cliff-path, which affords an opportunity of seeing the action of the sea in excavating the rocks along the coast. This path commands splendid views of Donegal Bay, including the long promontory of St. John's Point on the Donegal coast, and the towering precipices of Slieve League (1,972 feet above the sea).

Bundoran is now well served by the Great Northern Railway of Ireland, which connects it with Enniskillen, Derry, Belfast, Dundalk and Dublin. During the summer and autumn there is a most attractive day-tour to Enniskillen and back, by rail and steamboat on lower Lough Erne. The pottery and eel-weirs at Belleek; the famous salmon-leap at Ballyshannon; Kinlough, at the western end of Lough Melvin, a sheet of water $7\frac{1}{2}$ miles in length; Lough Glenade, surrounded by mountains, and the pretty

valley of the river Bonet, which flows from it into Lough Gill, near Sligo, are all within easy reach of Bundoran. Excursions to the different places named add much to the enjoyment of the visitor for health or relaxation. At **Kinlough**, distant $2\frac{1}{2}$ miles south of Bundoran, there is a hydrogen sulphide spring.

DONEGAL.

Donegal (Celtic, *Dun-na-ngall*, the Fortress of the Strangers), (population 1,323) deserves mention as the southern entrance to the wild coast and mountain scenery of the large and beautiful county of the same name. The town nestles at the eastern end of a sheltered creek on Donegal Bay. It is reached by road from Ballyshannon ($14\frac{1}{2}$ miles to the southward), or by the West Donegal Railway running from Strabane to Stranorlar and thence to Donegal, along the shores of sad and desolate Lough Mourne, through the wild mountain pass of Barnesmore Gap (where the line attains a height of 600 feet above sea-level), and by Lough Eask, embosomed in hills which tower to a height of 2,219 feet in Croaghgorm or the Blue Stack Mountains, some 3 miles north-north-west of the lake. Donegal may also be reached from Enniskillen by rail as far as Pettigoe, on the north shore of Lough Erne, and thence by road by Lough Derg, celebrated for hundreds of years throughout Europe as a place of pilgrimage. This is an unfrequented route, but one which cannot fail to please the antiquary, the geologist, or the lover of wild scenery. Donegal is a place of considerable antiquarian interest. The ancient castle of the O'Donnells stands in the town itself: the ruined abbey and its cloisters, founded in 1474 by Hugh Roe O'Donnell and his wife, Fingalla, for the Franciscan friars, are built on a rocky promontory overlooking the creek near the town. It was probably in this monastery that the famous *Annals of Donegal*—better known as the *Annals of the Four Masters*—were compiled between the years 1632 and 1636.

From Donegal the light railway, called the West Donegal Railway, runs westward along a winding course of 19 miles to Killybegs. The views looking across Donegal Bay are splendid, and the entire route is extremely picturesque. The railway

passes **Dunkineely**, overlooking McSwyne's Bay, a small village which possesses a sulphur spa of some repute.

KILLYBEGS.

Killybegs (Celtic, *C'alla-beaga*, Little Churches), the western terminus of the West Donegal Railway, is a town of some pretensions, with a population of 1,323. It nestles cosily on the western shore of a sheltered bay, the waters of which lave one side of the main street. The sea-bathing is good, and the place only needs development to make it a popular bathing-place. The fishing is excellent, numbers of fine salmon and mackerel being caught in the bay. Killybegs is a convenient rendezvous before a tour through Donegal from south to north, but the hotel accommodation is indifferent. Since 1899, a summer daily service of well-appointed coaches or long cars runs from Killybegs through the highlands and magnificent coast scenery of Donegal for a distance of about 100 miles to Rosapenna on Sheephaven, near Horn Head. The chief places on this route are Carrick, near the stupendous precipices of Slieve League (1,972 feet), Ardara, Glenties (the terminus of another branch of the West Donegal Railway), Dungloe, Gweedore (celebrated for its fishing), Falcarragh, Dunfanaghy, Cresslough and Rosapenna. The coaches also run daily southwards from Rosapenna to Killybegs, Dungloe being in each case the stopping-place for the night on this coach-journey of two days.

Two miles west of Killybegs, on the road to Carrick, is a beautiful inlet of the sea called Fintragh Bay, with an excellent bathing strand. "In the gardens of Fintragh House," writes Mr. Baddeley, "fruits ripen in the open air, such as one expects to find only in the most favoured nooks of the sunny south." The mildness of this sequestered place is in part due to the shelter afforded by Crownarad Mountain, which overhangs Fintragh Bay to the north, and rises to the height of 1,620 feet. In this way, sunshine from the south is trapped, while cold winds from the north are barred. The average annual rainfall at Killybegs in the ten years, 1890-1899, according to Mr. A. Brooke, was 59·87 inches on 241 days.

GWEEDORE.

Gweedore may be mentioned as a temporary health resort in the extreme north-west of Donegal. Standing on the banks of the Clady river, almost under the shadow of Errigal (the loftiest mountain of Donegal, rising to 2,466 feet above the sea), this little hamlet presents many attractions to the passing tourist or seeker after health. There is a first-class hotel, built many years ago by the late Lord George Hill. Not far from the hotel is the wild mountain pass of Dunlewy, above which towers the majestic peak of Errigal. Four miles to the west are the villages of Bunbeg and Derrybeg, at the former of which there is good sea-bathing, while the latter is the centre for the Irish industries, started under the fostering care of Mrs. Ernest Hart. At Crolly Bridge, 3 miles south, excellent lake and river fishing may be had in Lough Anure and the river Crolly. In the Clady river, close to Gweedore itself, there is splendid salmon fishing, tickets for which may be obtained of the manager of the Gweedore Hotel.

The extreme northern district of Donegal has of late years been opened to visitors by the establishment of first-class modern hotels, not only at Gweedore but also at Rosapenna, Portsalon and Buncrana, access to which is rendered easy by rail, steamer or coach. It is a beautiful country, but possesses a very uncertain, changeable climate, the barometric depressions which so often sweep across the Atlantic from south-west to north-east bringing with them stormy winds, clouds, and soaking rains. In fair weather the scenery of the fiords, mountains, lakes and valleys of North Donegal is splendid. The principal inlets of the sea are—from west to east—Sheephaven, Mulroy Bay and Lough Swilly. East of the Inishowen Peninsula stretch the broad waters of Lough Foyle, which with the river of the same name form the boundary between the counties Donegal and Londonderry.

ROSAPENNA.

About $1\frac{1}{2}$ statute miles north-north-west of the interesting village of Carrigart stands **Rosapenna Hotel**, built in 1892 by the late Earl of Leitrim and still managed under the supervision

of the Countess of Leitrim. It is a well-appointed house, constructed in great part of Scandinavian pine, the timber having been shipped at Stockholm and thence carried direct to Mulroy. The hotel is built on the famous Rosapenna sands, 300 yards from the cliffs of Muslack—a bold cliff frontage looking down upon Sheephaven. The sanitary arrangements are of the first order. Close to the hotel are excellent golf-links—an 18-hole course in a circuit of $3\frac{1}{2}$ miles—and tennis courts. A splendid sandy beach runs 5 miles south from the hotel, affording opportunities for bathing or walking. From the top of a hill named Ganiamore (682 feet) not far north of the hotel, there is an unrivalled view, embracing Horn Head, Tory Island, the placid waters of Mulroy Bay and Sheephaven, the far-stretching woods of Ards, and the towering heights of Muckish, Errigal and Slieve Snaght (the “Snow Mountain”) in distant Inishowen. Rosapenna will be found a delightful health resort for the jaded toiler in a great city. The dry sandy soil, the wonderful combination of sea and mountain air, and the ever-changing landscape and weather together, make up a most powerful tonic for mind and body.

PORTSALON.

Portsalon, on Lough Swilly, stands at the northern extremity of Ballymastocker Bay, the scene of the wreck of H.M. ship *Saldanha* in 1811. At Portsalon, Colonel Barton some years ago opened a large well-equipped hotel, which stands on the southern slope of a hill overlooking Lough Swilly (“The Lake of Shadows”), and commanding a splendid view of the opposite coast and the mountains of the Inishowen Peninsula. North of the hotel the coast scenery is very bold, and the sea has undermined the cliffs, so forming the far-famed “Seven Arches.” The Portsalon golf-links (18 holes), begin at the hotel. Three routes connect Portsalon with Rosapenna. By one the visitor drives through the historic district of Fanad by the head of Mulroy Bay, finally crossing Rawross Ferry to Carrigart, and so on to Rosapenna. A more direct route is by Moross and Rawross ferries. A third is by Milford, and thence along the western shores of Mulroy Bay to Carrigart and Rosapenna. Portsalon is reached from Derry by rail to Fahan, thence by steamer to Rathmullan,

from which there is a coach service during the summer months to Portsalon. There is excellent sea-bathing in the grounds of the hotel, and boating on Lough Swilly can also be enjoyed. Mr. Henry Hart, M.A., gives the annual rainfall at Carrablagh, $1\frac{1}{2}$ miles north of Portsalon, on the average of the ten years 1890–1899 as 45·74 inches on 247 days.

Rathmullan (population, 591) deserves mention, not perhaps as a health resort, but because it is the key to the routes through the Fanad Peninsula for visitors arriving by steamer from Fahan, a station on the Lough Swilly Railway, which runs from Derry to Buncrana. Close to Rathmullan are the ruins of a priory of Carmelite Friars, the more ancient parts of which date from the fifteenth century. The little town occupies a sheltered position on Lough Swilly at the foot of Croaghan Hill (1,010 feet), from which there is an extensive view of both Mulroy Bay and Lough Swilly.

BUNCRANA.

Buncrana (population, 735), distant by rail from Derry $12\frac{1}{2}$ miles, is situated near and between the mouths of the Owenkillew and Cranagh rivers, on the eastern shore of Lough Swilly. The name means “the foot or the mouth of the Cranagh river.” It is sheltered from north and east by the highlands of the Inishowen Peninsula, but it is exposed to the strong south, south-west and west winds, which are so prevalent in the district.

Mr. Thomas Colquhoun, B.A., Univ. Dubl., F.R.Met.Soc., of Rocfoot, Buncrana, and Dr. Walter Bernard, F.R.C.P.I., of Ardaravan, Buncrana, and 14 Queen Street, Londonderry, have favoured me with the following information as to the geology and climatology of Buncrana and its neighbourhood:—

The annual mean temperature of the sea opposite the mouth of Lough Swilly is 52° F.—a remarkably high reading for the latitude (55° 8' N.), and of course due to the north-easterly flow of the warm waters of the North Atlantic. The annual mean temperature of the air of Buncrana is 48° F. The prevailing winds are north-west, west and south-west. The average rainfall at Rockfort for the ten years, 1890 to 1899 inclusive, was 41·14 inches on 228 days. Long temperate summers and short mild winters enable the weak and infirm to take almost daily exercise on the dry,

sandy, horizontal footpaths. Open-air exercise may, in fact, be enjoyed all the year round along the shores of the inland sea known as Lough Swilly, the waters of which are derived from collateral branches of the Gulf Stream. A few inches below the surface, the temperature of the sea-water varies only some two degrees Fahrenheit between summer and winter. There are a fair number of trees in the grounds of Buncrana Castle at the mouth of the Cranagh river, and also in the valley of the Owenkillew. The atmosphere is as a rule clear, and fogs are by no means prevalent. Up to 40 feet above sea-level the subsoil is for the most part sandy, and therefore dry. Dr. Walter Bernard states that the dryness of the soil is due in a great degree to the upheaval of primitive metamorphic rocks from 30° to 90°. The geological formation is metamorphic quartzite, with occasional greenstone dikes and outcrops of primitive limestone. The surface is undulating, with occasional knolls (or "kopjes") and basins of drift, covered over with a rich alluvial soil.

Complaints have reached me as to the defective drainage of Buncrana. But the natural fall is good, and I am given to understand that plans have already been made and approved for a new system of drainage. There is a high-pressure water supply, but the water contains peaty matter, the catchment area being upland and mountainous.

As to the health of Buncrana, Dr. W. Bernard and Dr. Neal Nelson, J.P., the local Medical Officer of Health, report that a residence at this place produces excellent results in cases of anæmia and debility, sent thither for change of air. Very little scrofula or tuberculous disease, other than pulmonary, is seen. Phthisis, however, is not uncommon, though hæmoptysis is infrequent. Bronchitis and catarrh are uncommon—not so pneumonia and pleuritis. Asthma is very rare. Renal diseases are very uncommon, calculus and gravel being unknown. Endemic diseases, including enteric fever, are very rare. The population is long-lived, "senile decay" being a common cause of death.

Buncrana is yearly growing in favour as a health resort and watering-place. The Lough Swilly Hotel is a large and well-placed house, built on a promontory overlooking the Lough. There are two sets of golf-links—a ladies' course close to Buncrana, and a gentlemen's course at Lisfannon, one mile south.

Buncrana is the headquarters where many places of interest in Inishowen may be explored. Ducree Head, with its fort and lighthouse, is some 6 miles north. The Gap of Mamore is an excursion too seldom undertaken.

A railway is in process of construction from Buncrana to **Cardonagh**, a town of 765 inhabitants, about 12 miles further to the north-eastward. When completed, this line will develop the neighbouring villages of Malin and Culdaff into seaside resorts. Malin village is on the sheltered shore of a land-locked inlet of the sea called Trawbreaga Bay, with sandy shores. Culdaff is on Culdaff river, which runs into a pretty bay on the eastern shore of Inishowen. The well-wooded grounds of Culdaff House adjoin the village.

The following table (see p. 539) illustrates the climate of the region we have been considering. The observations were taken at Malin Head, the most northerly point of Ireland.

MOVILLE.

Moville (population, 1217) is a watering-place of some size and good repute in Inishowen, and near the mouth of Lough Foyle. It is $18\frac{1}{2}$ miles north-north-east of Derry, whence it is reached by road or water—unfortunately there is no railway communication. Moville is well sheltered by the Inishowen highlands on the west and north. It faces south-east, and the sandy promontory on the opposite shore of the Lough which ends in Magilligan's Point, protects it from the Atlantic seas. There are considerable attractions at Moville for those who like an unconventional summer resort. All the shipping of the port of Derry passes in front of the town. Three miles north-east is the old fortress of Greencastle, built by Richard de Burgo in 1305, off which the Anchor, Allan, and States liners put in for the Derry tender with mails. Three miles further on is Inishowen Head, with its two lighthouses and cliffs towering to over 300 feet. Excursions may also be made to the ridges which shelter the place on the landward side, namely, Squire's Cairn (1,058 feet) and Craignamaddy (1,054 feet).

The average yearly rainfall at Prospect Villa, Moville, during the ten years, 1890–1899, was 40.95 inches on 242 days.

MALIN HEAD, CO. DERRY, LAT. 55° 23' N. ; LONG. 7° 24' W.
233 FEET ABOVE SEA-LEVEL.

MONTH.	Barometer at 8 a.m. Means 1871-95.	TEMPERATURE OF THE AIR, 1871-1895.				
		Dry Bulb 8 a.m.	Wet Bulb 8 a.m.	Mean Daily Maximum.	Mean Daily Minimum.	Mean Temp.
January	29.795	40.6	39.0	45.0	37.6	41.3
February	29.844	41.0	39.5	45.5	38.3	41.9
March	29.842	41.0	39.3	46.5	38.5	42.5
April	29.855	44.2	42.2	50.1	41.7	45.9
May	29.918	48.7	46.3	54.3	45.5	49.9
June	29.934	53.6	51.2	59.0	50.8	54.9
July	29.851	55.9	53.7	60.9	53.5	57.9
August	29.830	56.1	53.9	61.7	54.0	57.2
September . . .	29.869	53.5	51.1	58.4	51.1	54.8
October	29.798	48.2	46.1	52.4	45.6	49.0
November . . .	29.755	43.9	42.0	48.0	40.9	44.5
December . . .	29.768	41.3	39.6	45.2	38.1	41.7
Means	29.838	47.3	45.3	52.3	44.6	48.5
				48.5		

COUNTY DERRY.

THE CITY OF DERRY.

Derry (Celtic, *Doire*, a Place of Oaks) is a historic city. It owes its origin to an abbey founded on its site by St. Columbkille in the year A.D. 546. The city proper is perched on a hill 119 feet high, overlooking, from the left bank, the Foyle, a noble river, exceeding at this point 1,000 feet in width. The population was, in 1891, 33,200, but in 1901 it had risen to 39,873. The surrounding hills consist of primary schistose rocks, and occasional beds of granular limestone and greenstone.

In his *History of England*, Lord Macaulay tells how, during the struggle of the houses of O'Neil and O'Donnell against the authority of James the First early in the seventeenth century, "the ancient city of Derry had been surprised by one of the native chiefs: the inhabitants had been slaughtered, and the houses reduced to ashes. The insurgents were speedily put down and punished: the Government resolved to restore the ruined town: the Lord Mayor, aldermen, and common council of London were invited to assist in the work: and King James the First made over to them in their corporate capacity the ground covered by the ruins of the old Derry, and about six thousand acres in the neighbourhood." The great historian goes on to say:—"This country, then uncultivated and uninhabited, is now enriched by industry, embellished by taste, and pleasing even to eyes accustomed to the well-tilled fields and stately manor-houses of England. A new city soon arose which, on account of its connection with the capital of the empire, was called Londonderry. The buildings covered the summit and slope of a hill which overlooked the broad stream of the Foyle, then whitened by vast flocks of wild swans. On the highest ground stood the cathedral, a church which, though erected when the secret of Gothic architecture was lost, and though ill qualified to sustain a comparison with the awful temples of the middle ages, is not without grace and dignity."¹

Such was the city upon whose devoted walls and bastions burst the tempest of war in the mid-winter of the year 1688. After various assaults had been defeated, the city was closely beleaguered until on the night of July 28, 1689, the boom which had been thrown across the river by the besiegers at Culmore was broken, and the merchantmen *Mountjoy* and *Phœnix*, escorted by the *Dartmouth*, a frigate of 36 guns, commanded by Captain John Leake, brought relief to the beleaguered and sore-pressed garrison and raised the siege—"the most memorable in the annals of the British Isles"—after it had lasted one hundred and five days. "Five generations," writes Lord Macaulay, "have since passed away, and still the wall of Londonderry is to the Protestants of Ulster what the trophy of Marathon was to the Athenians. A lofty pillar, rising from a bastion which bore during many weeks the heaviest fire of the enemy, is seen far up and far down the Foyle.

¹ *The History of England*, by Lord Macaulay.

On the summit is the statue of Walker, such as when, in the last and most terrible emergency, his eloquence roused the fainting courage of his brethren. In one hand he grasps a Bible. The other, pointing down the river, seems to direct the eyes of his famished audience to the English top-masts in the distant bay. Such a monument was well deserved: yet it was scarcely needed: for in truth the whole city is to this day a monument of the great deliverance. The wall is carefully preserved: nor would any plea of health or convenience be held by the inhabitants sufficient to justify the demolition of that sacred enclosure which, in the evil time, gave shelter to their race and their religion. The summit of the ramparts forms a pleasant walk. The bastions have been turned into little gardens. Here and there, among the shrubs and flowers, may be seen the old culverins which scattered bricks, cased with lead, among the Irish ranks. One antique gun, the gift of the Fishmongers of London, was distinguished, during the hundred and five memorable days, by the loudness of its reports, and still bears the name of 'Roaring Meg.' The cathedral is filled with relics and trophies. In the vestibule is a huge shell, one of many hundreds of shells which were thrown into the city. Over the altar are still seen the French flag-staves, taken by the garrison in a desperate sally. The white ensigns of the house of Bourbon have long been dust; but their place has been supplied by new banners, the work of the fairest hands of Ulster. The anniversary of the day on which the gates were closed, and the anniversary of the day on which the siege was raised, have been down to our own time celebrated by salutes, processions, banquets and sermons: Lundy has been executed in effigy; and the sword, said by tradition to be that of Maumont, has, on great occasions, been carried in triumph. There is still a Walker club and a Murray club. The humble tombs of the Protestant captains have been carefully sought out, repaired and embellished. It is impossible not to respect the sentiment which indicates itself by these tokens. It is a sentiment which belongs to the higher and purer part of human nature, and which adds not a little to the strength of states. A people which takes no pride in the noble achievements of remote ancestors will never achieve anything worthy to be remembered with pride by remote descendants."

Mr. J. Conroy gives the average annual rainfall at Clooney Terrace, Londonderry, in the ten years, 1890–1899, as 40·09 inches on 244 days.

The shallow waters of the co. Derry, or eastern shore of Lough Foyle, are not conducive to bathing. Accordingly we have to travel by the Belfast and Northern Counties Railway a distance of some 25 miles, until we reach the open sea outside the flat triangular plain called Magilligan Peninsula. Along its north shore a fine shelly beach stretches for 4 miles to Magilligan Point, opposite Greencastle on the Inishowen shore of Lough Foyle. Magilligan Peninsula formed the base-line on which the Trigonometrical Survey of Ireland was laid down in 1826. The railway-run from Derry is very attractive. At first the line hugs the eastern bank of the beautiful Foyle with its woods and villas. At Culmore (5 miles), near which the boom was thrown across the river in the famous siege of 1688, the estuary widens into Lough Foyle. At Limavady Junction (15½ miles) there is a charming inland view towards Limavady and Dungiven with the lofty Sperrin Mountains—the highest of which is Sawel, 2,240 feet—for a background.

BELLARENA.

Bellarena (20½ miles), the marine residence of Sir Frederick Heygate, Bart., is at the mouth of the Roe river and near the well-wooded base of Binevenagh (1,260 feet), a hill remarkable for its geological formation, including its steep basaltic top.

In the fifteen years, 1866–1880, the average annual rainfall at Bellarena (lat. 55° 4' N.; long. 6° 56' W., and 12 feet above the sea) was 37·43 inches. May was the driest month, with an average fall of 2·00 inches; October the wettest, with 4·13 inches.

DOWNHILL.

Downhill (26¼ miles) is near the seat of the Right Hon. Sir Hervey Bruce, Bart., H.M.L. The station is at the eastern extremity of Magilligan Peninsula. There are cliffs and caves, the latter carved out of the limestone and chalk, which is here, as along the Antrim coast, capped by basalt. The scenery is very romantic, and during the summer Downhill attracts many visitors from Derry for sea-bathing and a day in the country.

CASTLE ROCK.

Castle Rock (population, 133) is a small but popular watering-place $1\frac{1}{4}$ miles further on, not far from the mouth of the river Bann. There is a strand suitable for bathing, and the Railway Company have given considerable facilities for the development of the place. The air is pure and fresh, and the climate is essentially bracing.

From Castle Rock the railway runs along the coast, and afterwards the western bank of the river Bann, 6 miles to **Coleraine**—a busy, prosperous town of 6,845 inhabitants, a notable centre of the Ulster linen trade, and also famed for its salmon fisheries near the mouth of the Bann. A branch-line runs from Coleraine northwards to two important watering-places—Portstewart and Portrush. The average annual rainfall at Coleraine in the ten years, 1890–1899, was 36·78 inches on 209 days.

PORTSTEWART.

Portstewart is built on the western side of a rocky promontory, 4 miles north-north-east of Coleraine. Terraces and villas are springing up along the northern face also of the jutting headland which terminates in Portstewart Point, and the population is increasing yearly. The little town is $1\frac{1}{2}$ miles from Portstewart station on the Portrush branch of the Belfast and Northern Counties Railway; but a steam tramway connects the railway-station and the town. Portstewart offers the threefold attraction of a bracing air, a dry subsoil, and good sea-bathing. The season lasts from June to September.

COUNTY OF ANTRIM.

PORTRUSH.

Portrush (population in 1901, 1,942) is the chief watering-place in the north of Ireland. Its one drawback is an almost complete absence of trees. The climate is essentially bracing, for the air is nearly always in active movement—at times indeed the brave west and north-west winds are rather too much in evidence on this

exposed northern coast. Yet the force of the Atlantic waves spends itself on the chain of rocky islets called the Skerries, which form a natural breakwater towards the north and north-east.

Dr. John Charles Martin, Medical Officer of Health, read a paper on July 5, 1900, on "Portrush from a Medical Point of View," before the North of Ireland branch of the British Medical Association. The following information is culled from that paper:—

The town itself is built on a rocky peninsula jutting into the sea in a direction almost due north-west, the neck of the promontory being a deposit of sand of considerable depth, widening out in opposite directions, as it approaches and joins the mainland, into two fine beaches, one running more or less south for about a mile, the other east for a distance fully twice as far. The situation of these beaches, with the elevated house-covered rock between them, makes it almost always possible to get a spot on one beach or the other, for young children and people who are not strong to enjoy themselves, sheltered from whatever quarter the wind may happen to be blowing. The area of the town is about 211 acres, but of such a peculiar form that it possesses a seaboard of about 2 miles. Therefore, residence in the town itself may be fairly considered to hold out the advantages of life on board a ship, the Atlantic Ocean beating practically all round—a sojourn, from this point of view, being as good as a sea voyage, without the latter's attendant inconveniences and other distressing accompaniments.

Another feature is that the rain rapidly percolates through the sandy surface soil, and finds its way, either by flowing along over the sloping surface of the rock on which the town stands, or through the fissures in its mass, into the sea. The surface consequently dries with wonderful rapidity after even the heaviest showers. This fact is of importance when it is remembered how beneficial it is for the young to be able to take exercise without running the risk of getting their feet wet, and also how necessary it is in cases of many invalids that they should be protected from the danger of walking or sitting down on damp soil. Further, the exhausting effects of oppressive heat need never be experienced by any visitor, on account of the prevalence of a refreshing sea-breeze which is never absent even during the sultry weather of the dog days, on the extreme point of the headland called Ramore Hill.

The scheme for providing a water supply was begun in 1878,

Mr. Tate, the then county surveyor, being the engineer for the work. The first loan obtained amounted to £4,000, and an additional loan of £2,500 was required in 1880 for completing the work. The plan was as follows:—A considerable tract of country, about 2 miles out, at a good level above the town, was selected as being suitable for a catchment area. The water from this district was collected, and carried by open channels into a reservoir where it was stored, then it was conducted through a suitable filter-bed into the clear water-basin, from which it was piped into the town. Certain minor improvements were carried out in 1882 and 1891 at a cost of £350 and £470. By the year 1896 the supply was found inadequate, and a further scheme was set on foot and subsequently completed, by which the storage capacity was doubled, and at the same time the opportunity was seized to remedy what up to this time constituted an obvious weak point in the original plan—namely, the conduction of the water along open channels and the collection of the supply from a tract of country dotted over with farms. The springs in this region have now been tapped, and from them a series of underground tubes convey the water to a subterranean well-head, whence it is piped to the waterworks, and so the two defects, which left the supply liable to contamination, have been completely overcome, and Portrush has at present a supply of water amply sufficient for all domestic purposes, of good quality, and removed from danger of contamination from all possible sources. The amount of money expended on this scheme of enlargement and amendment was £2,500, making the total spent on the waterworks very little short of £6,000.

The sewerage system was designed by Mr. L. L. Macassey, of Belfast. The configuration of the ground on which the town stands readily lent itself to the conveying of the sewerage matter to the sea by suitable gradients. The main system catches the sewers of the five or six principal streets, and discharges it at a point at the back of the harbour where the north pier joins the practically inaccessible west cliffs of Ramore Head. A valve at the outlet regulates the discharge so that the outflow takes place only when the tide is running in the desired direction, and the sewerage matter is thus conveyed into the deep sea. Two smaller systems intercept the private sewers of the rows and terraces of houses along the sea-front, and thus prevent any polluting of the

foreshore. The contractors who carried out the work were Messrs. M'Crea and M'Farland, of Belfast, the cost being £2,500. An additional scheme has latterly been carried out at a cost of £260, so that, on the sewerage system, the town has spent a sum approaching £3,000.

Portrush is remarkably free from epidemic disease. In the cholera visitation of 1849, which raged in the neighbouring towns of Coleraine and Bushmills, only one case occurred in Portrush—the patient being a man who died shortly after his arrival from Coleraine. Within the past eighteen years also there has never been anything like an epidemic of enteric fever.

As regards the remaining zymotic affections, Portrush compares favourably with other towns. The epidemics run a short course, attributable to the healthy surroundings and an abundance of fresh air. As regards the advantages to be obtained from the well-known effects of sea-water-bathing, every facility is afforded, while the new baths lately opened in the Northern Counties Hotel (open to the public) are justly considered to be among the finest in the kingdom.

In conclusion, Dr. Martin considers that few seaside resorts offer greater advantages than Portrush to those requiring a long or short residence on a dry soil, together with the bracing effects of sea-air, and the possibility of enjoying to a very great extent outdoor exercise in fairly sheltered situations.

Portrush may be looked on as the headquarters whence Dunluce Castle, Bushmills, the Giant's Causeway, Dunseverick, White Park Bay, and the wonderful swinging bridge at Carrick-a-rede may be visited. The rainfall of that part of the northern coast along which these places are situated is well represented by the records kept at Dundarave, the beautiful seat of Sir Francis E. W. Macnaghten, Bart., not far from the neat and prosperous town of Bushmills. The average of the 10 years, 1890–99, was 36·70 inches on 226 days. A steam tramway runs from Portrush *via* Dunluce Castle and Bushmills to the Giant's Causeway, a distance of 8 miles. From the Causeway eastward to Ballycastle (13 miles), there is a well-appointed car-service during the summer months.

BALLYCASTLE.

Ballycastle (population, 1481) possesses many claims to rank as an attractive seaside resort and bathing-place. The town proper is about half-a-mile from the sea, occupying high and hilly ground at the foot of Knocklayd (1,695 feet) towards the north. This curious mountain, from which there is a splendid view extending across the North Channel to Islay, Jura, Cantyre and Arran, derived its Celtic name from its shape—*Cnoc-léithid*, meaning literally, the Hill of Breadth, *i. e.* Broad Hill. Marine Ballycastle is on the shore of Ballycastle Bay, west of the river Glenshesk, a mountain stream formed by the confluence of the Carey river with the Glenshesk river near the ruins of Bonamargy Abbey. The word "Bonamargy" means the foot or mouth of the river Margy, and it is interesting to note that in an old map by Cristo Cole in 1694, the river which flows into Ballycastle Bay is called the Margy Water. Rathlin Island in the same map is called Raghtlay. From the mouth of the river a fine sloping sandy beach stretches northward towards the cliffs which finally culminate in the precipices of Ben More or Fair Head, the Robogdiun Promontorium of Ptolemy, and the extreme north-eastern point of Ireland. The summit of Fair Head is 639 feet above the sea, and from it beautiful views by land and sea are obtainable. The sea-bathing at Ballycastle is good, and there are croquet and lawn-tennis grounds and golf-links.

Ballycastle Bay is sheltered on the north by **Rathlin Island**. This remarkable island, known to Ptolemy as *Insula Picinia*, contains 3,398 acres and stretches $6\frac{1}{2}$ miles from east to west. The average breadth is $1\frac{1}{2}$ miles. Its shape was quaintly compared by Sir William Petty to "an Irish stocking, the toe of which pointeth to the main lande." The intervening channel, called the *Race of Sloch-na-mara*, or the Valley of the Sea, is 6 miles across. Through it the tide ebbs and flows with great velocity, causing a "nasty" sea should the weather be contrary. Rathlin is a historic island. St. Columba founded a church there in the sixth century. Many centuries later it afforded refuge to Robert Bruce of Scotland. There are magnificent cliffs of chalk and basalt, which rise to 447 feet at Slieveacarne on the north-west

coast. Towards the east the basaltic cliffs are columnar. The population of Rathlin in 1891 was 365 souls.

A light railway, $16\frac{1}{4}$ miles in length, connects Ballycastle with Ballymore, a station on the Belfast and Northern Counties Railway, so completing railway communication with Belfast, Coleraine, and Londonderry. But a far more attractive way in which to approach Ballycastle, if the visitor has time to spare, is by road from Larne. This "coast route" is one of the finest drives in Ireland. The scenery both by land and sea is beautiful all along the road, which is itself a monument of engineering skill. The traveller is lost in wonder at the variety and grandeur of the geological formations, as well as the scenic beauty of the famous Glens of Antrim, which were in bygone days the territory of the McDonnells, and which are still inhabited by almost pure-blooded Celtic clans.

CUSHENDUN.

Cushendun (Celtic, *Cois-abhann-Duinn*, the End of the river Dun) is a neat village and bathing-place on the banks of the Glendun river, which flows through the valley of the same name from its source on the north-eastern slopes of Slieveanorra (1,676 feet). There are several houses along the beach suitable for summer residences. Cushendun is 12 miles' drive from Ballycastle, the road crossing the intervening hills at a height of 600 feet or upwards.

CUSHENDALL.

Cushendall (Celtic, *Cois-abhann-Dhalla*, the End of the river Dall), is a charming little town of 397 inhabitants, on the Glenaar and Dall, about a quarter of a mile from the sea, the beach affording good sea-bathing. It is 16 miles by road from Ballycastle, and contains a couple of comfortable inns.

About $1\frac{1}{2}$ miles south of Cushendall is Red Bay, so called from the wonderful outcrop of Devonian rock or Old Red Sandstone, which makes its appearance at Waterfoot or Glenariff, a little village at the mouth of the river which descends from Glenariff, the most beautiful and romantic of the Glens of Antrim.

On the north-west side of the glen the hills attain their highest point in Trostan (1,817 feet). The Belfast and Northern Counties Railway have made Glenariff easy of access, and have constructed a light railway from Ballymena to Retreat in the glen, the nearest point to Cushendall that the steep gradients in the district will permit the narrow-gauge line to touch. At the instance of the Railway Company, paths, footbridges and handrails have been constructed by their engineer throughout this romantic glen, which equals if it does not excel in beauty the far-famed Dargle in the co. Wicklow. A large tea-house has already been erected at the foot of the glen for the use of visitors.

Half-way between the village of Glenariff, or Waterfoot, and Carnlough, a small watering-place, is **Garron Tower**, near Garron Point, where the geological formation is very peculiar. East of Glenariff there are extensive downs, which attain an elevation of 1,179 feet in Knockore. These downs, as they approach the sea, vary from 600 to 800 feet in height. From their eastern face a stupendous landslip must have taken place at some remote epoch, and the detached masses of chalk and basalt have formed a plateau or terrace varying from about 200 to 300 feet above the sea. On this rocky shelf the Marchioness of Londonderry in 1848 had built a fine castellated mansion of basalt. This is Garron Tower, the dark almost ebon-black stone of which adds to its picturesque appearance. The adjoining grounds are beautifully laid out and planted. They command magnificent views of the coast and sea—the dome-like outline of Ailsa Craig and the low-lying coastline of Wigtonshire showing on the eastern horizon, while the headlands of the Mull of Cantyre, with Sanda Island and Arran, are seen away to the north-eastward. Garron Tower was used as a summer residence by the Londonderry family until two or three years ago. It is now a first-class hotel, under the personal management of Mr. Henry McNeill, of Larne, whose *chairs-à-banc* and carriages run to the hotel from Larne. Dr. Robert Esler, formerly of Belfast, and now resident at Peckham, London, S.E., describes Garron Tower in the following words:—"The gardens, greenhouses, vinery, and rosary display an amount of taste and skill seldom surpassed, and are all the more striking here amidst their rugged surroundings, as if the convulsions of nature had only paved the way for a paradise of flowers. Art has here triumphed

over the desolation of nature, and has transformed the *débris* of a geological catastrophe into a scene of matchless order and the rarest beauty."

There is perhaps no place where a few peaceful days could be spent with more benefit and enjoyment than at Garron Tower.

CARNLOUGH.

Carnlough, a small but neat and cheerful watering-place, is 4 miles south of Garron Point at the north-western end of Carnlough Bay. Its normal population in 1891 was 592, but there are a good many visitors in summer, who enjoy the quiet little place, its good sea-bathing and its beautiful scenery. To the south-west there are several hills exceeding 1,000 feet in height—the highest being Collin Top (1,426 feet). The sandy beach shelves gradually, affording safe bathing for timid bathers.

GLENARM.

Glenarm (population, 1,248) is a town of some size, beautifully situated on Glenarm Bay, near the mouth of a mountain stream which flows north-eastward through the deer-park and well-wooded demesne of the baronial residence of the McDonnells, Earls of Antrim. Over the gateway in a lofty barbican tower which forms the entrance to the castle is the following inscription—"With the leave of God this Castle was built by Sir Randle McDonnell, knight, Erle of Antrim, having to his wife Dame Aellis O'Nill, in the year of our Lord God, 1636. Deus est adjutor meus." While Glenarm is not a place to stay at, the traveller cannot fail to be interested in its scenery and industries. Kelp is manufactured from the seaweed with which the coast abounds, and iron-ore, limestone, and chalk, for the manufacture of whiting, are exported. There is good bathing in the bay. From Glenarm to Larne the drive of $11\frac{1}{2}$ miles along the coast is most enjoyable. The road was constructed in 1834, and is a triumph of engineering skill. The Maiden Rocks with their respective lighthouses are seen 5 miles out at sea, while on the land side of the road the cliff scenery is in places very fine, particularly at Ballygally Head, nearly 300 feet high, with basaltic columns locally called the

“Cornsacks.” Skirting Drains Bay, the road passes through a short tunnel of basalt called Black Cave, and finally reaches Larne, 4 miles south-south-east of Ballygally Head and at the entrance to Larne Lough, an arm of the sea running several miles south between the mainland on the west and the curious peninsula called Magee on the east.

LARNE.

Larne (population, 6,660 in 1901) deserves mention as a convenient port of arrival for visitors to the north-east and north of Ireland. There is an excellent Royal Mail steamer service between Stranraer on Lough Ryan in Wigtonshire and Larne Harbour, which in turn is connected with Belfast (24 miles) by the Belfast and Northern Counties Railway. The town is well-kept and is lighted with electricity. The curved shore between it and the ferry to Island Magee—a distance of one mile—is called the *Curraun*, a sickle. At the ferry stands a square tower called Olderfleet Castle, where Edward Bruce landed with a force of 6,000 men in 1315, in response to an offer of the crown of Ireland, made to him by the Ulster chieftains.

A good modern hotel called “The Olderfleet” stands on the Curraun near the ruined tower from which it takes its name.

WHITEHEAD.

Whitehead is a favourite and rapidly developing watering-place at the extreme north-eastern end of Belfast Lough, 14½ miles by rail from Belfast, 5 miles from Carrickfergus, and 8½ miles by rail from Larne. Owing to the enterprise of the Belfast and Northern Railway Company, a great impetus has been given to building at Whitehead, roads and paths have been constructed, and the objects of interest in the neighbourhood have been made accessible—such as the ruins of Castle Chichester on the coast, and Blackhead, where there are some fine caves. Further afield, in Island Magee, are the Gobbins, a range of basaltic cliffs, 240 feet high, and perforated by seven caves which can be explored at low water. The air at Whitehead is eminently fresh and bracing, and the sea-water is clear and buoyant. The

sea view is quite open towards the east and south-east, the Copeland Islands forming a conspicuous object in the latter quarter off the coast of Down.

CARRICKFERGUS.

Carrickfergus is an ancient port and the county of a town of 4,188 inhabitants (in 1901), distant $9\frac{1}{2}$ miles by rail from Belfast, and well situated on the northern shore of Belfast Lough. It enjoys no reputation as a health resort, but should be visited by strangers staying in the neighbourhood because of its antiquity and its historic associations. The name means *The Rock of Fergus*, a king who was lost in a gale off its headland about the year 320 B.C. Carrickfergus Castle, still occupied, is a massive Anglo-Norman fortress, which was built by de Courcy in 1178 to protect his Ulster possessions. It was captured by Robert and Edward Bruce in 1315, but again fell into English hands in 1317, after the battle of Dundalk, in which Edward Bruce was slain. In 1688 Lord Iveagh held the fortress for James II., but it was taken by Schomberg a year afterwards, and on June 14, 1690, William III. landed on its quay. Since 1843 the castle has been garrisoned for the Crown, and it is now used as an armoury. This grand specimen of an Anglo-Norman fortress is founded on a rock 30 feet in height, and overlooks Belfast Lough, which washes its foundations on three sides. The donjon or keep is a massive square tower of five stories, 90 feet high, with walls 9 feet thick. A draw-well, within the walls, enjoyed a reputation for its chalybeate properties, but these have been traced to the presence in the bottom of the well of a quantity of nails and armour, which had from time to time been thrown into it.

Two miles west of Carrickfergus are the salt-mines of Duncrue. The rock-salt lies in three seams, 150 feet in thickness, in the Triassic sandstone, which borders the Lough all the way from Whitehead to Belfast.

The average annual rainfall at Carrickfergus (Dorisland) during the ten years, 1890-1899, was 40.32 inches, and the average annual number of rainy days was 255. The observer was Mr. F. W. McCullough, C.E.

BELFAST.

Belfast, a maritime city and Parliamentary borough returning four members, the metropolis of the Province of Ulster and the commercial capital of Ireland, is situated on the Antrim bank of the river Lagan near its mouth, 101 miles north of Dublin, in lat. $54^{\circ} 36' N.$, and long. $5^{\circ} 56' W.$ The area of the city within its new boundaries comprises 16,504 acres, including 1,788 acres of tideway. A large portion of the city also lies in the co. Down, and is called Ballymacarret. The name Belfast means the ford (Celtic, *beal*) of the sandbank or bar (Celtic, *feursat*, gen. *feirste*), Bealfeirste being contracted into Belfast. When John de Courcy invaded Ulster in 1177, he erected a fortress near the ford across the shallows at the mouth of the Lagan, and this was the origin of the great Ulster city. Belfast is finely situated at the head of Belfast Lough, an arm of the Irish Sea about 14 miles long, and on an average 4 miles wide. It is essentially a modern town, and in recent years its growth has been phenomenal, both in wealth and in population. In 1757 the population was 8,549; in 1810 it had increased to 30,720. In 1851 it was 100,301; in 1861, 121,602; in 1871, 174,412; in 1881, 208,122; in 1891, 255,950. Estimated to the middle of 1901, and with the addition of certain suburban districts, it comes out as 350,862—the figures used in the Reports of the Registrar-General for Ireland. The rank of “city” was conferred upon Belfast in 1888, and in 1892 its chief magistrate received the title of Lord Mayor. It is a busy, thriving place and the centre of much commercial activity—shipbuilding and linen manufacture being its chief industries, next to which come ropemaking, tobacco manufacture, printing and chromo-lithography. A magnificent water supply will soon be available from a catchment area of 9,000 acres in the heart of the Mourne Mountains, 30 miles distant. This great waterworks scheme will cost upwards of £2,000,000 sterling. A comprehensive system of main drainage is also now in working order, the outfall works having been recently completed at a cost of £300,000.

For the following detailed information, I am indebted to Dr. Henry Whitaker, D.P.H., Medical Superintendent Officer of Health for the City of Belfast.

The urban sanitary district of Belfast includes the site of the city and a portion of the harbour of Belfast, also a part of the Lagan valley extending about 3 miles to the south-west from the centre of the city. This area would include about 15 square miles, of which the city site would cover fully 5 miles square. The city is situated on a low alluvial plain at the mouth of the river Lagan; the Lagan valley being an extension of the plain to the south-west. The ground rises from the city rapidly to the north-west, forming a series of hills from 1,180 to 1,196 feet high, which extend for 5 miles from a point 4 miles west to a point 3 miles north of the city. The hills present a series of escarpments screening the city to the north-west. From the hills the land falls in undulating folds to the borders of Lough Neagh, which is 13 miles west of the city and 48 feet above the level of the sea. The land to the right of the Lagan valley rises to a height of from 400 to 500 feet. The range of hills to the north-west with their escarpments, as already stated, protect the city to a certain extent from the winds blowing from this direction, but to the south-west winds which course along the Lagan valley, and to the north-east winds coming from the harbour, the city is fully exposed. The harbour or lough extends 12 miles to the north-east, with an average width of $3\frac{1}{2}$ miles.

The hills to the north-west of the city are about 1,200 feet high, and are composed geologically of basalt, chalk, limestone, Lias clay, and a deposit of New Red Sandstone probably 1,500 feet thick, the upper portion being composed of dark red clay, and the lower portion in the slope towards the valley being formed of soft red sandstone, which extends into the co. Down and there rests unconformably upon Silurian shales. Reposing on the surface of these rocks, irregular thick beds of boulder clay are found on the slopes of the valley, while in the hollow forming the site of the city, beds of estuarine clay from 20 to 50 feet thick occur above the boulder clay. In some parts of the city this estuarine clay fills up hollows or basins in the boulder clay, from which in many cases a supply of water is obtained by pumps. The impervious character of the latter formation has an important bearing upon the draining and evaporation of the district, and the soft beds of estuarine clays with their underbedded layers of organic matter demand the careful attention of engineers and

architects in the construction of foundations of public and private buildings.

In 1899, the births in the Belfast Registration Districts, which include 49,201 acres, numbered 11,875, and the deaths 8,306. Of the deaths, 1,378, or 16·6 per cent., were returned as due to special febrile or so-called "zymotic" diseases, including 152 from measles, 25 from scarlatina, 1 from typhus, 53 from influenza, 230 from whooping-cough, 74 from diphtheria, 6 from ill-defined fever, 280 from enteric fever, 71 from simple cholera, 426 from diarrhoea and dysentery, 20 from "puerperal fever," and 40 from other "zymotics." In addition to the foregoing, 1,715 deaths, or 20·6 per cent., were attributed to tuberculosis, including 223 from *tuberculosis mesenterica*, 192 from tubercular meningitis, 1,156 to pulmonary phthisis, and 144 to scrofula and other forms of tubercular disease. As the boundaries of the municipal district were enlarged on May 1, 1899, it is not practicable to give the death-rates represented by the above figures.

Dr. Whitaker reports that anæmia and debility, scrofula and other forms of tuberculosis and pleurisy are of common occurrence. Pulmonary phthisis and hæmoptysis, catarrh and bronchitis are all very prevalent. Pneumonia and asthma are not very common. Acute renal dropsy is infrequent, but chronic albuminuria is often met with. The latter is usually associated with the large white kidney variety of chronic nephritis, granular kidney being decidedly uncommon. Calculus and gravel are rare. Rheumatism, rheumatoid arthritis, and various forms of neuralgia are very common. Dr. Whitaker has observed nothing noteworthy as to the prevalence of skin diseases. Malarial affections are unknown. Both diarrhoeal diseases and enteric fever are very prevalent according to season. Diphtheria was formerly rare, but seems now to be on the increase. Endemic sore throat and scarlatina are of frequent occurrence. Longevity is below the average among the population of Belfast, owing to the large preponderance therein of the working-classes. Chronic bronchitis is prevalent, and a common cause of death among the aged.

The annual rainfall at Belfast is about 33 inches. In the 15 years, 1866–1880, as observed at Queen's College (lat. 54° 36' N.: long. 5° 56' W., at an altitude of 68 feet above the sea) by Mr. W. Taylor, it was 34·03 inches, distributed among the months as

follows:—January, 3·31 inches; February, 2·67 inches; March, 2·12 inches; April, 2·04 inches; May, 2·21 inches; June, 2·18 inches; July, 3·04 inches; August, 3·15 inches; September, 3·31 inches; October, 3·84 inches; November, 3·01 inches; December, 3·15 inches. In the subsequent 15 years, 1881–1895, the average annual fall was 32·34 inches, the average annual number of rainy days being 178. These lower figures are in some measure due to the incidence of the dry years 1887 and 1893. In 1887 the rainfall was only 23·45 inches on 153 days; in 1893 it was only 25·92 inches on 170 days.

COUNTY DOWN.

The water is very shallow at the head of Belfast Lough, and the tide recedes a long way from the coast until Grey Point is reached—a promontory some $8\frac{1}{2}$ miles north-east of Belfast on the co. Down shore of the Lough. The Bangor branch of the Belfast and Co. Down Railway runs along or near the coast, passing the important suburbs of Sydenham (2 miles) and Holywood (4 miles). The latter is an ancient place, and had a population of 3,840 in 1901. Further on, the pleasant seaside suburbs of Marino and Cultra are passed, as well as picturesque Craigavad (6 miles), where there are many fine residences. At **Helen's Bay** ($8\frac{1}{2}$ miles) there is a fine stretch of sand and shingle, the water is pure and bracing, and the bathing is good. The neighbourhood is very attractive. From Grey Point a beautiful view of the Lough and its shores may be obtained. Crawfordsburn Glen, the property of Captain Sharman-Crawford, D.L., is a beautiful ravine filled with trees and ferns, while Clandeboye, the historic demesne of the Marquis of Dufferin and Ava, with its celebrated Helen's Tower, lies a couple of miles inland from Helen's Bay station. All the places named may be visited in the course of a day from Belfast, of which city they are marine suburbs. At **Carnalea** ($10\frac{3}{4}$ miles), from which also there are splendid views of the Lough, are the grounds of the Royal Belfast Golf Club (the premier Irish Golf Club). Visitors are allowed the privileges of the club on the introduction of a member, and a payment of five shillings a week should the period of the visit exceed three days. A bathing-place available at all times of the tide is just below the club-house.

BANGOR.

Bangor (Celtic, *Beannchar*, The Horns, *i.e.* Pointed Hills), 12 $\frac{1}{4}$ miles from Belfast, is one of the largest watering-places in Ireland. Its normal population in 1901 was 5,903, but during the yachting and bathing season it far exceeds that figure. It is a place of great antiquity, for in A.D. 555 or thereabouts St. Comhgall founded a monastery here, which was long a famous seat of learning until sacked by the Danes in 818. It was restored by St. Malachy in 1121, and on its site the parish church of the Church of Ireland was erected in 1623. For centuries Bangor Abbey was one of the foremost seats of learning in Europe.

The great attractions of modern Bangor are its fresh air and open sea, and its facilities for bathing, boating, fishing and yachting. It is the headquarters of the Royal Ulster Yacht Club, of which the Marquis of Dufferin and Ava is commodore. The town is built on a series of hills rising from the shores of a fine bay. Numerous terraces and villas have of late years been built on a promontory separating Bangor Bay from the still larger and more open Ballyholme Bay, a mile to the eastward, where there is an extensive stretch of sandy beach. The suburb of Ballyholme may now be regarded as part of Bangor. It is sheltered from the east by the low ridge which ends in Ballymacormick Point. Handsome villas have been built facing the sea along a high raised beach above the strand.

Bangor is 5 miles almost due north of Newtownards, a large and prosperous town near the extreme northern end of Strangford Lough. The road passes by Conlig Hill, where there are lead-mines, the Bangor waterworks, and not far from Helen's Tower and the woods of Clandeboy.

A first-class modern hotel is a pressing want in Bangor, but there is good lodging accommodation, and villa residences abound. The town is in constant communication with Belfast not only by rail but also by sea; the Belfast and Co. Down Railway Company have established an excellent steamboat service on the Lough, the steamship *Slieve Bearnagh* making three voyages daily each way, except on Saturday, when there are but two sailings from Belfast to Bangor.

GROOMSPORT.

Groomsport is a little seaside place, $2\frac{1}{2}$ miles beyond Bangor. Schomberg landed here in 1689 with 10,000 men, to march through Belfast and besiege Carrickfergus. At the eastern end of the village of 284 inhabitants stands the parish church, and a fine Elizabethan mansion, the residence of Mr. R. Percival-Maxwell, D.L. Boating, fishing and bathing may be enjoyed. The air is bracing, and beautiful clear water breaks in waves on a beach of yellow sand. The views seaward from Groomsport are very fine, embracing the Antrim coast, the Mull of Cantyre, Ailsa Craig, and the Copeland Islands beyond Orlock Point.

DONAGHADEE.

Donaghadee (population in 1891, 1,886), 22 miles by rail from Belfast, *via* Comber and Newtownards, is finely situated on the coast facing the Copeland Islands, which shelter it from the north. The harbour works, which cost an initial sum of £145,000, consist of a pier, with a lighthouse, and an outlying breakwater, all built of grey Anglesea limestone. Although it stands on an iron-bound coast, Donaghadee is a favourite watering-place. The rainfall is moderate—31 inches a year—owing to its position. The rain-bearing south-west winds are desiccated as they pass over the Mourne Mountains, while the highlands of Antrim intercept the rains which are borne on westerly and north-westerly winds. In easterly winds there are no mountains sufficiently near on the leeward side to act as condensers. The principal street sweeps round the bay, and is open to the harbour and sea. The coast of Wigtonshire is often distinctly seen in clear weather at a distance of 21 miles. At Templepatrick, by the seaside about $1\frac{1}{2}$ miles south of the town, St. Patrick is reputed to have landed upon one occasion, and the mark of his foot is still pointed out on the rocks. Bathing, boating and fishing are the pastimes of Donaghadee. The bathing is particularly good, especially at the Warren, where there is a choice between a sandy beach and deep water. Geologists will

find at Donaghadee the best section of fossiliferous Ordovician and Silurian rocks in Ireland, the fossils being most abundant at low tide at the southern end of Coalpit Bay, a mile south of the town. An enormous rath, or dun, 70 feet high, rises between Moat Street and Shore Street. From its summit there is a beautiful view. The place of a town park is supplied by the gardens of the Manor House through the generosity of its owner, Mr. Daniel Delacherois, D.L.

The climatology of Donaghadee is clearly demonstrated by the annexed table, which is based on observations extending over twenty-five years.

DONAGHADEE, CO. DOWN, LAT. 54° 38' N. : LONG. 5° 32' W.
26 FEET ABOVE SEA-LEVEL.

MONTH.	Barometer at S. a. m. Means, 1871-1895.	TEMPERATURE OF THE AIR, 1871-1895.								Rainfall Means, 1866-1895.
		Dry Bulb S. a. m.	Wet Bulb S. a. m.	Daily Maximum.	Daily Minimum.	Maximum.	Years.	Minimum.	Years.	
January	29·854	39·7	38·9	44·2	35·8	55	1875, 80, 89, 92	14	1881	2·90
February	29·894	40·0	39·1	45·5	36·6	56	1894	16	1895	2·34
March	29·883	40·7	39·5	47·3	37·1	65	1874	25	1892	1·97
April	29·883	44·8	43·1	51·2	40·5	64	1873, 74, 75	30	1876, 82, 95	1·86
May	29·952	49·7	47·6	56·1	44·6	69	1895	30	1873	2·21
June	29·950	55·1	53·0	61·5	49·7	77	1887	36	1880	2·03
July	29·880	57·3	55·4	63·2	52·2	81	1876	40	1883	2·82
August	29·869	56·9	55·4	62·5	52·6	77	1890	38	1886	3·27
September	29·916	53·6	52·4	60·0	49·4	71	1893	36	1882, 94	2·74
October	29·834	47·6	46·3	53·6	43·3	65	1895	21	1892	3·22
November	29·819	43·4	42·3	48·5	39·4	60	1894	27	1878, 83	3·10
December	29·840	40·4	39·5	45·8	36·3	56	1885, 88, 94	20	1879	2·85
	29·832	47·4	46·0	53·3	43·1	81	1876	14	1881	31·31
				48·2						

To the southward of Donaghadee, for fully 20 miles, stretches the **Peninsula of Ards**, forming the eastern shore

of Strangford Lough, a vast inlet of the sea studded with islands, anciently called *Altitudo Ulteriorum juxta Mare orientale*. The peninsula is full of interest to the archaeologist by reason of its abbeys, churches, castles, raths, and cromlechs. It is best explored by a tour commencing in the north at **Newtownards**, a prosperous town of 9,110 inhabitants (in 1901), overlooked by Scrabo Hill (540 feet), crowned with a lofty tower, thence passing down the eastern shore of Strangford Lough to Portaferry in the south, and on to Ballyquintin, the southern extremity of the peninsula, and finally working up the coast of the Irish Sea to Donaghadee in the extreme north-east. The length of this tour is about 48 miles.

PORTAFERRY.

Portaferry is a seaport town of 1,624 inhabitants (in 1891), which overlooks the narrow channel that connects Strangford Lough with the Irish Sea. This channel or sound is 5 miles in length, but only half-a-mile in width, and through it the ebbing and flowing tides sweep with dangerous impetuosity. Hence the Danish name of Strangford, that is, the *violent fjord or inlet*.¹ Near the entrance to the sound is the dangerous Angus Rock (commonly called the Rocking Goose by a ludicrous corruption of Rock Angus). Ferry-boats frequently cross the channel from Portaferry to Strangford quay on the mainland, whence it is $8\frac{1}{2}$ miles by road to Downpatrick. The highest ground in the Ards district is $1\frac{1}{2}$ miles north-east of Portaferry, where Blackbank Hill rises to 339 feet, and Windmill Hill to 262 feet. From the former there is an excellent view of Strangford Lough and its numerous islands. Off the eastern coast of Ards is Burial Island, the most easterly point of Ireland (long. $5^{\circ} 25' W.$). The visitor to Donaghadee who desires to make the tour through the Ards will find fair hotel accommodation at Portaferry.

¹ The ancient Irish name was Lough Cuan, the Harbour Lake; while old Latin writers called it *Fretum Brenense*, Brena being the original name of the district.

ARDGLASS.

Ardglass (population 554) was in olden time the chief port in Ulster, and the ruins of several Anglo-Norman castles attest its former greatness. There is a good harbour, and the town is built on the slopes surrounding a small but deep bay in which good bathing may be had. The mountains in the Isle of Man shut in the eastern horizon across the sea. South of the little town stretches a high common known as the Downs of Ardglass, which forms a splendid natural promenade. The short grass is literally carpeted with wild flowers, while the air is delightfully fresh and sweet. The coast is rock-bound, forbidding bathing until Coney Island is reached, at the south-eastern extremity of Killough Bay. The name Ardglass means in Irish the Green Height (*ard*, height: *glas*, green), and it is evidently derived from the green hills in the neighbourhood, which are called respectively the Ward of Ardglass and the Ward of Ardtole. From each of these vantage-points a charming panoramic view unfolds itself. The Ardglass Golf Club has an excellent course on the Downs near Ardglass Castle. In the reign of Henry IV. Ardglass was a corporate town and a royal borough. Of the five ancient castles which defended the place, two—King's Castle and Queen's Castle—have disappeared. Choud or Cowd Castle and Margaret's Castle survive in ruins: Jordan's Castle is in excellent preservation. The tower of another stronghold called Horn Castle was incorporated in the present Ardglass Castle by Lord Lecale in 1790.

The harbour is secure, allowing ships of 500 tons burthen to enter and clear at all times. It is the headquarters of the herring-fishery in Ulster, in which about 3,000 fishermen are engaged. More attention should be paid by the local sanitary authorities to the drainage of the place, for a main intercepting sewer is required to prevent pollution of the foreshore within the precincts of the harbour. A light railway, 8½ miles in length, connects Ardglass with **Downpatrick**, the county town, built on a kopje or hill overlooking the marshes of the river Quoile. In the graveyard on the south side of the cathedral (restored between 1790 and 1826), St. Patrick is said to be buried, and thither in 1186 John de Courcy is reputed to have translated the remains of St. Brigid and St. Columba, two of the most renowned of St. Patrick's followers.

A quarter of a mile north-west of the centre of the town still exists the huge earthen fort or "dun," from which Downpatrick takes its name. The population was 3,132 in 1891.

The railway from Ardglass is a branch of the Belfast and Co. Down system. It passes **Killough**, a neat fishing village of 585 inhabitants with a small harbour, and Ballynoe, where there is a remarkable stone circle of Ordovician grit and a few erratic blocks of granite.

Killough is somewhat larger than Ardglass, and much favoured as a seaside resort.

Dr. Arthur W. S. McComiskey, M.B., B.Ch., B.A.O., R.U.I. Medical Officer and Medical Officer of Health for the Killough Dispensary District, in which Ardglass is situated, has been good enough to report as follows on his district, which includes an area of 18,000 acres and has a population of 4,000 :—

"I. A. *Anæmia and Debility*, except amongst the poorest classes, are rare. A number of women (wives and daughters of fishermen and agricultural labourers) engage in embroidering work, in their own homes, and very often induce an anæmic and debilitated state of health by confinement within doors, late hours, want of exercise and tea-drinking.

"Patients coming here to recruit do so rapidly.

"B. *Scrophula and Tuberculous Diseases, except Phthisis Pulmonalis*.—These conditions are decidedly rare in Ardglass and its neighbourhood.

"Patients sent here improve very considerably.

"C. *Diseases of the Respiratory Organs*.

"*Phthisis* (with special reference to hæmoptysis).—During the past three years and eight months I have registered five deaths from phthisis in Ardglass. Three of these were girls at boarding-schools—two of them in the Masonic School, Dublin, and one in Liverpool. They came home to die. The fourth, in my opinion, contracted the disease by nursing one of the three. The fifth case is the only one with which Ardglass should really be credited. He resided in a low, damp house. Very slight hæmoptysis occurred in one of the cases.

"The population of Ardglass is probably 500.

"Phthisical visitors, if in an early stage, improve wonderfully in summer, but the easterly winds are very trying to such cases in spring.

"*Bronchitis and Catarrh* are very prevalent during winter and spring.

"*Pneumonia*.—Acute croupous pneumonia is decidedly rare. Not so broncho-pneumonia, supervening on influenza. This latter is common, and accounts for the majority of deaths among the aged.

"*Pleurisy* is quite uncommon in Ardglass and its neighbourhood.

"*Asthma*.—I am aware of two subjects of bronchial asthma in Ardglass. I have never been asked to see this complaint in a visitor.

"*D. Renal Diseases*.

"*Acute Renal Dropsy* is decidedly rare.

"*Chronic Albuminuria* is uncommon. I can recollect only two cases among permanent residents during the past six years. Among visitors I have seen two other cases, both of whom seemed to improve.

"*Calculus and Gravel*.—I have never seen a case in either a permanent resident or visitor.

"*E. Rheumatism, Rheumatoid Arthritis, and Neuralgias*.—I see about two cases of acute or sub-acute rheumatism in Ardglass in each year. Rheumatoid affections and neuralgias are common. I am not aware that visitors with such complaints derive benefit.

"*F. Diseases of the Skin, particularly Eczema*.—Practically the only skin affection I see in Ardglass is eczema, and even this is exceedingly rare. Hitherto it has invariably yielded to treatment. I have found sea-bathing productive of good results as regards simple eczema of the extremities.

"*G. Endemic Diseases*.

"*Malarial Affections*.—Such are not seen in Ardglass, except occasionally in a sailor or person who has served or resided in a malarial region. I think the climate of Ardglass is favourable to the treatment of these cases.

"*Typhoid Fever*.—There has not been a single case in the past six years.

"*Diarrhoea* is not common.

"*Scarlet Fever*.—Ardglass keeps wonderfully free from scarlet fever. In six years I have attended four cases, and this notwithstanding the fact that the country around has on more than one occasion been 'full of it.'

"*Diphtheria*.—I have never seen a case in Ardglass or its neighbourhood.

"*Endemic Sore Throat* is uncommon.

"II. *The common causes of death, and frequency of old age among the permanent residents*.—My remarks under this heading include the townland of Coney Island, which is situated on the sea-shore immediately outside Ardglass. It is a hamlet of about fifteen or eighteen very poor-class cottages (population about 50). Nearly every cottage is let to visitors during the summer months.

"In this population of about 550 (Ardglass 500, Coney Island 50), I have in three and eight-twelfths years registered 60 deaths. Thus:—

At 60 years and above.	Under 1 year.	Phthisis	Other causes.
28	9	5	18

At least three of the 18 'other causes' should be added to the 28 'at 60 years and above.' The poor are in the habit of deducting anything at all from two to twenty years from the correct age when it is a question of recovering money from an Insurance Society.

"The ages of the 28 registered at '60 years and above' were:—66, 67, 78, 87, 65, 70, 85, 75, 77, 99, 78, 80, 101, 74, 70, 66, 75, 92, 72, 86, 76, 61, 68, 68, 86, 81, 65, 60 = 76 years on an average (exactly).

"III.—**The system of drainage adopted**.—There is no proper drainage system. Of several batches of houses, each batch seems to have a distinct system of drainage and sewerage of its own. Privies and middens prevail.

"IV.—**The water supply** is on the whole insufficient in quantity and defective in quality. It is by open shallow wells, and closed shallow wells with pumps."

Dr. McComiskey adds that the soil of Ardglass is a stiff clay. He considers the climate delightfully bracing in summer and autumn, rather trying in spring, cold and dreary in winter. The prevailing winds are south-east and east, summer sea-breezes from these points largely contributing to their dominance.

DUNDRUM.

Dundrum (population, 474) is a neat and pleasant village, situated on the shore of the Inner Bay, a winding inlet of Dundrum Bay, which extends from the promontory of St. John's Point, near Killough and Ardglass, on the east, to the steep slopes of Slieve Donard, on the south-west. On a low, wooded hill, west of the little town, stand the majestic ruins of the barbican and massive donjon-keep of Dundrum Castle, the building of which is ascribed to John de Courcy, for the Knights Templars, towards the close of the twelfth century. The castle was erected on the site of an ancient rath known as *Dun Rudhraidhe*, or Rury's Fort. The word Dundrum means "The Fort on the Ridge" (Celtic, *Dun*; *Druim*, a back or ridge). Only at or near high water is there bathing at Dundrum, but the vast neighbouring sand-dunes afford endless opportunities for enjoying the fresh air of this bracing and delightful district. The sand-hills of Murlough, south of the narrow entrance to the inner bay, are the most prolific site in co. Down for prehistoric implements. The Ballykinler sand-dunes stretch along the north side of the bay. On both sides the sand-dunes or "rabbit-warrens" are of unusual size and extent, and yield a rich botanical harvest. St. John's Point is 9 miles east of Dundrum, from which it may be reached by road, crossing to the Ballykinler sand-dunes by boat or ford. The tower of the new lighthouse at St. John's Point, completed in 1893, rises 140 feet above the sea. It shows a red revolving light of 130,000 candles, as well as a fixed white and red light for the guidance of coasting traffic. The lighthouse guards the dangerous reefs of Ordovician rock, glaciated from north-west, which form St. John's Point and the adjacent shores.

At Castlewella, 3 miles inland from Dundrum, the annual rainfall on the average of the ten years, 1890-99, was 38·58 inches, on 164 days.

NEWCASTLE.

Newcastle (population, in 1891, 898, but now probably much larger) is a first-class watering-place, famous for its beautiful scenery, its mountain climbing, and its splendid golf-links. The

town consists for the most part of one principal street, more than a mile in length, and running along the curved shore of Dundrum Bay to terminate on the first steep slopes of Slieve Donard (2,796 feet). Newcastle's reputation as a health resort is comparatively modern. It is true that Felix Magennis, in 1588, built a castle close to a ford on the south bank of the Shimna river (*river of bulrushes*) just as it enters the sea. This ford was thenceforward known as *fearsat na chaisleáin nua*, the Ford of the New Castle—and so arose the name of the place. About sixty years ago the ruined castle was removed to make room for a hotel—the Annesley Arms—which is still a hostel of repute. From that time Newcastle has been yearly growing in favour as a health resort and bathing-place. It is 38 miles by rail from Belfast, with which there is each way a frequent service of fast trains over the Belfast and Co. Down system, the express trains performing the journey in about an hour. The railway-company have within the past few years built a palatial hotel—the Slieve Donard Hotel—near their terminus at the northern end of the town. It contains about 120 bedrooms, is lighted throughout with electricity, has hot and cold fresh and salt-water baths and Turkish baths, and is surrounded by beautiful grounds. Northward from the hotel the golf-links, with 18-hole course, extend along the sand-dunes towards Dundrum. The Co. Down Golf Club have established their handsome club-house within 200 yards of the Slieve Donard Hotel. The Annesley Arms and the Bellevue are also good hotels, and there are many villa residences and comfortably-furnished lodgings for the accommodation of visitors.

A good deal of rain falls at Newcastle, owing to the proximity of the Mourne Mountains, but owing to its steepness and rocky or sandy character the surface dries with great rapidity, and the climate, though changeable, is healthy. Visitors to Newcastle may indulge to their hearts' content in bathing, mountain-climbing, trout-fishing, sketching and golf. The absence of harbour accommodation interferes seriously with boating and yachting as holiday pastimes at this charming place, the attractions of which are enhanced by the proximity of three beautiful demesnes, to which the noble owners grant free admission on specified days. These demesnes are Donard Lodge on the slopes of Slieve Donard, the property of Earl Annesley; Castlewellan Park, the Earl's

residence, distant 4 miles; and Tollymore Park, the seat of the Earl of Roden, at the neat village of Bryansford, 2½ miles inland from Newcastle. The great charm of Tollymore Park lies in the beauty of the Shimna river, which flows through it, and in the unrivalled views of the sea and mountains which it commands.

The mountain range that towers over the plains of Lecale and Iveagh on the north, and over the Irish Sea on the south and east, long ago received the name of "The Kingdom of Mourne." Mr. Robert Lloyd Praeger, B.A., B.E., M.R.I.A., President of the Dublin Naturalists' Field Club, thus describes the district:—"The Mourne Mountains form the most elevated land in Ulster, and one of the most picturesque mountain-groups in Ireland. They cover an elliptical area of about 14 by 7 miles, the longer axis of which runs in a north-eastern and south-western direction. At their eastern extremity, close to Newcastle, the Mournes descend steeply into the Irish Sea, and at their western end drop with equal abruptness into the sheltered waters of the beautiful Bay of Carlingford." Mr. Praeger tells us that the Mourne Mountains are the denuded remains of a mass of intrusive rock that has thrust itself through the thick series of Ordovician and Silurian strata, which stretch from co. Down away (south-westward) across Armagh and Monaghan into Cavan and Louth. This intrusive rock is a fine-grained and very tough grey granite, composed of quartz, orthoclase, albite, and green or black mica, which last, according to the Professor, contains lithium, and is referable to the rare species called zinnwaldite.¹ In the Mourne granite the quartz has crystallized first instead of last, as is usual in rocks of this kind.

Appended is a list of the principal summits of the range, with their heights of and above 2,000 feet, and their expressive Irish names:—

Slieve Donard ("St. Dominic's" or "St. Donart's Mountain"), but more anciently Slieve Slanga ("Slainge's Mountain")	2,796
Slieve Commedagh ("The Mountain of Watching")	2,512
Slieve Bingian ("The Mountain of the Sharp Peak")	2,449
Slieve Bearnagh ("The Gapped" or "Broken Mountain")	2,394
Slieve Meel-Beg ("The Little Bare Mountain")	2,310
Slieve Lamagan	2,306
Slieve Meel-More ("The Great Bare Mountain")	2,237
Shanslieve ("The Old Mountain")	2,204
Slieve Muck ("The Pig Mountain")	2,198
Chimney Rock Mountain	2,152
Eagle Mountain	2,084
Shanlieve	2,055
Doan ("The Hook Mountain")	2,000

¹ Cf. *Proceedings of the Royal Academy*, Third Series, vol. i., no. 3, 1890.

The only main road which penetrates the Mourne Mountains is that which runs from Hilltown, north of the range, to Kilkeel on the coast. This road rises above 1,200 feet, under the slate and granite cliffs of Pigeon Rock Mountain (1,749 feet). West of Slieve Bingian, with its saw-like crest, there is a fine mountain glen, to which the name of the "Happy Valley" has been given. This is the source whence the new water supply of the city of Belfast is to be taken. Mr. Praeger thus describes this glen:—"A huge moraine blocks its lower end—a great ridge of stones and gravel thrown across the valley by some old-time glacier. The river has now cut through one end of it, but the level alluvial plain that extends from it for two miles up-stream speaks of the time when this natural dam stood intact, and banked up the waters behind it in a long, narrow lake. Soon a lake will again occupy the valley, for this is the spot selected for the new reservoir of the Belfast Water Commissioners. A massive embankment of clay will replace the ancient glacial dam, and once more water will fill the glen."

From the foregoing it will be seen what boundless opportunities for mountaineering exist in the "Kingdom of Mourne."

There is a splendid coach-drive of 26 miles along the coast from Newcastle to Rostrevor and Warrenpoint on Carlingford Lough. The road at first skirts the base of Slieve Donard and its mighty shoulders, which descend abruptly into the sea. It passes the fishing village of Annalong (7 miles), and continues to hug the shore as far as the hamlet of Ballymartin (9½ miles), whence it runs inland to Kilkeel (12½ miles).

KILKEEL.

Kilkeel (Celtic, *cill caol*, narrow church) is a thriving seaport of 1,367 inhabitants (in 1891), with a harbour, a good fishing industry, and an export trade in granite from the Mourne Mountains, which are here distant from 3 to 5 miles. The intervening plain is formed of a vast deposit of glacial *débris*, which stands up as a solid cliff 30 to 40 feet in height along the shore. In front of this cliff there is a beach of shingle and sand, on which there is fair bathing. The road, which hitherto ran at first southward, and then south-westward to Kilkeel, now turns westward, and

finally north-westward to Rostrevor. It is a beautiful drive. On the right the mountains and the wooded glades of Mourne Park, the seat of the Earl of Kilmorey; on the left the waters of Carlingford Lough unfold themselves; and in the distance the grand old Keep of Greencastle, built by the Anglo-Normans in the thirteenth century, still seems to guard the eastern shore of the Lough.

The scenery between Lisnacree and Rostrevor is most beautiful. The road passes the hamlet of Killowen (John's Church), from which the late Lord Chief Justice of England derived his title.

The heights overlooking Carlingford Lough on its eastern or co. Down shore are, from south to north, Knockshee (1,144 feet), Spelga (Celtic, *Speilgearh*, the place of pointed rocks), (1,298 feet), Ballynagelty (1297 feet), Slieve Ban (the White Mountain), (1,595 feet), and Slieve Dermot (1,442 feet). This statement will testify to the sheltered character of the health resorts on Carlingford Lough.

ROSTREVOR.

Rostrevor (population, 660) is romantically situated near the mouth of the Kilbroney river, which falls into a well-sheltered bay at the north-eastern end of Carlingford Lough. The village stands on high ground with a beautiful environment of heights and woods. Half-a-mile south is Rostrevor Quay, and close to it is the Great Northern (Mourne) Hotel, now under the direct management of the Great Northern Railway (Ireland) Company. This is a well-equipped comfortable hotel, with electric light and good sanitation. The front windows command beautiful views of Carlingford Lough and the Carlingford hills on its western side. Behind the Mourne Hotel is a quarry in a great dyke of uralitic diabase, "a handsome rock, locally called green granite" (R. L. Praeger). Through the luxuriant woods which clothe the hill-side behind the hotel, a path leads up to the "Cloughmore" (Celtic, *cloch mor*, the big stone), a gigantic block of granite, weighing some 30 tons, which rests on the native rock—Lower Silurian slate—at a height of 957 feet above sea-level. The boulder was really carried to its present position from the northward by the ice during the glacial period. But tradition has it that the rock was

thrown from Carlingford Mountain across the Lough by the giant Finn MacCoul. The view of Warrenpoint and the surrounding district from this remarkable boulder is splendid.

A very neat and new hotel stands near the Mourne on the road to Rostrevor—the “Glenmore”; and there are also several villas near the shores of the Lough between Rostrevor and Warrenpoint. Sangster’s Hotel is in the town itself.

Rostrevor is well adapted for a winter health resort. It is completely sheltered from northerly and easterly winds, but is open to the south-west and west. The force of the wind from the latter quarters is, however, broken by the hills which encircle Rostrevor Bay. Although rain falls heavily and frequently, as is usual in hilly districts, yet the ground dries quickly, and the water runs off the sloping surface with surprising rapidity.

Rostrevor Sanatorium.—In August 1899, a private sanatorium for the treatment of pulmonary consumption and chest complaints was opened under the direct superintendence of Dr. F. Howard Sinclair, of Belfast, Honorary Physician to the Foster-Green Hospital for Consumption near that city. The Rostrevor Sanatorium is situated on the slopes of the Mourne Mountains about 350 feet above sea-level. Like Rostrevor, from which it is distant $2\frac{1}{2}$ miles, the sanatorium is protected by hills from north and east winds. Its climate is wonderfully mild, owing to its southerly aspect and to the nearness of the sea, Carlingford Lough being only $1\frac{1}{2}$ miles distant. The rainfall is moderate considering its hilly situation, and as the soil is gravel there is no lodgment of water. Great attention is paid to the open-air treatment of tuberculosis, and the patients are encouraged to live as much as possible out of doors. In inclement weather they can still do so in a verandah adjoining the house and in shelters in the capacious pleasure-grounds, in which there are also sleeping-huts. Great attention is paid to diet. There is an electric installation. The drainage system and the water supply are excellent. All the milk used comes from a specially chosen source, and only from a herd which has stood the tuberculin test. The terms are moderate—three and a half guineas a week, exclusive of extras.

WARRENPOINT.

Warrenpoint (population in 1901, 1,817) is built along the shore at the northern end of Carlingford Lough, of which a charming view is obtained from the promenade running for half-a-mile along the beach. It is connected with Rostrevor by a tramway, $2\frac{1}{2}$ miles in length. There are many villas and lodging-houses. The hotel accommodation also is above the average, the Great Northern Hotel being a new, commodious, and well-managed house. It is connected by telephone with the companion Great Northern (Mourne) Hotel at Rostrevor. The bathing at Warrenpoint is good at high water, and there is every facility for boating on the Lough. A ferry connects Warrenpoint with Omeath on the co. Louth shore, and the London and North-Western Railway Company's Lough steamer plies between Greenore, Greencastle, Rostrevor, and Warrenpoint at intervals each week-day.

A branch of the Great Northern Railway of Ireland connects Warrenpoint with the important town of **Newry** (population in 1901, 12,587), 6 miles distant. There is a daily service of about twelve trains each way on week-days, and six trains each way on Sundays. The route is very picturesque, especially at Narrow Water, $1\frac{1}{2}$ miles from Warrenpoint, where are the ruins of Narrow Water Castle, a fortress erected by the Duke of Ormonde in 1663 on the site of a much older castle built by Hugo de Lacy, Earl of Ulster, in 1212, to defend the estuary of the Newry Water, which flows through a deep valley with wooded slopes on each side. It was of Newry that Dean Swift wrote the lines (no longer applicable)—

“High Church, low steeple,
Dirty streets, and proud people.”

The average yearly rainfall at Warrenpoint (Summerhill) in the ten years 1890–1899, was 36·44 inches on 130 days, according to Mr. B. M. Kernan. The number of “rainy days” seems suspiciously small.

COUNTY LOUTH.

OMEATH

Just opposite Warrenpoint, on the co. Lough shore of Carlingford Lough, is the little watering-place of **Omeath**. It is a station on the Newry and Greenore Railway, which was constructed some years ago by the London and North-Western Railway Company in connection with their steamboat service between Holyhead and Greenore. Omeath nestles cosily on the shore at the foot of Clermont Carn, 1,674 feet high. On the same line of railway, $5\frac{1}{2}$ miles to the south-east, is the ancient town of **Carlingford** (population, 554), celebrated as the place where St. Patrick landed on the occasion of his second visit to Ireland, A.D. 432. At the bidding of King John, the Anglo-Norman Baron de Courcy built a massive fortress here on a jutting rock overlooking the Lough. Its romantic ruins are still known as King John's Castle. The intention was that this castle should defend the western shores of Carlingford Lough, as the sister fortress of Greencastle did its eastern shores. The walls of this picturesque ruin are 11 feet thick in places. Close by the town is the ruined monastery, founded by Richard de Burgh, Earl of Ulster, in 1305, for the Dominicans. The views of this quaint old place from the Lough and neighbouring Greenore are beautiful. Immediately behind the town Carlingford Mountain, or Slieve Foy, rises so abruptly to a height of 1,935 feet as materially to lessen the amount of sunshine, the afternoon hours passing in shade. The Carlingford oyster-beds were famous in former times, but have fallen in repute.

GREENORE.

Greenore, the creation of the London and North-Western Railway Company, occupies a spit of land which projects north-eastwards into Carlingford Lough at its southern end. The entrance to the Lough from the Irish Sea is through a strait, which gradually narrows from its mouth between Cranfield Point on the co. Down shore, and Ballagan Point on the co. Louth shore 3 miles south-south-east of Greenore. At the latter place the

strait opens into Carlingford Lough, the village of Greencastle, on the co. Down shore, being connected with Greenore by a ferry $1\frac{1}{2}$ miles across. Abutting on the pier at Greenore is the hotel, built and managed by the London and North-Western Company. It contains 36 bedrooms, and is most comfortable. In addition to the Greenore Hotel, the Company have built four bungalows close to the golf-links, a course of 18 holes. These bungalows are surrounded by pine and fir plantations. They are lighted throughout by electricity. They are rented by the week, month, or year, and are delightful residences. From the hotel the beach stretches for some $2\frac{1}{2}$ or 3 miles south-eastward to Ballagan Point. Sea-bathing may be had close to the hotel, and there are bathing-huts and tents on the beach. Boating, sailing and fishing are the other amusements of this pleasant locality, which enjoys a breezy, bracing climate. From observations taken by Mr. T. Chambers, it would appear that the average annual rainfall in the ten years, 1890–1899, at Greenore was 31·33 inches, on 167 days. As the soil is sandy, it is evident that the place may be looked upon as unusually dry. The strait between the open sea and the Lough is protected by Haulbowline Island—a rock on which stands a lofty lighthouse, showing a fixed white light 104 feet above the water. The geological formation of the Carlingford Mountains is trap in various stages of crystallization, and Carlingford Lough itself is a rock basin due to glacial action. Near Greenore an ancient sea margin, or terrace of shelly gravel, may be traced at a height of about 10 feet above sea-level. This terrace runs along the coast as far as Dublin Bay, though at varying levels.

As one gazes at the hoary and dismantled ruins of the old-time fortresses of Carlingford and Greencastle, and at the splendid hotel and offices erected by the great English Railway Company at Greenore, a historic parallel comes into the mind. The Anglo-Norman invaders built their strongholds at the beginning of the thirteenth century to cover their advance into Ulster and its fair plains and fields. So even at the close of the nineteenth century a new invasion has taken place, and from their stronghold at Greenore the invaders have pushed their lines of advance in the shape of railways—westward to Dundalk, northward to Newry. Happily for Ireland, it is a peaceful invasion bringing wealth,

prosperity, and happiness in its train. The London and North-Western steamers, *Rostrevor*, *Connemara*, and *Galtee More*, are replete with every modern convenience, and perform the open sea passage from Greenore to Holyhead in a little over four hours, travelling if need be at a speed of $17\frac{1}{2}$ knots. The distance from Greenore to Holyhead is 80 miles.

Greenore is a capital centre from which to make excursions by land or water to neighbouring places. There are drives through the Carlingford Mountains which cannot be surpassed for beauty or wildness. For example, a visit may be paid to Ravensdale Park by taking train from Greenore to Bellurgan, a station on the Dundalk and Greenore line, driving thence to Ravensdale and returning by road or rail to Greenore.

The Dundalk and Greenore Railway, opened in 1873, is $12\frac{1}{2}$ miles in length. It skirts the northern shore of Dundalk Bay, and then turns north-eastward to Greenore, crossing a spur of Carlingford Mountain which ends in Ballagan Point. The Newry and Greenore Railway is more recent. It was opened in 1876, and is 14 miles in length.

DUNDALK.

Dundalk is a large and busy town, with a population of 13,067 in 1901. It has prospered owing to the establishment of extensive railway and locomotive works by the Great Northern (Ireland) Railway Company. It is a place of great antiquity, and played an important part in Anglo-Norman times, when it was justly looked on as the key to the Province of Ulster. Mr. J. Barton, of Farndreg, Dundalk, returns the annual rainfall on the average of the ten years, 1890–1899, as 30.95 inches on some 158 days (the latter figure is the average of only six out of the ten years).

DROGHEDA.

Drogheda.—The county of the town of Drogheda has recently increased its area, and now includes in its borough 1,520 statute acres. Its population in 1901 was 12,765. It is, as is well known, situated on the banks of the river Boyne, some 5 miles

west of the mouth of that river. The course of the Boyne is neatly described in an elegiac couplet, written by Necham, Abbot of Cirencester, who died A.D. 1217 :—

“Ecce Boan qui Trim celer influit, istius undas
Subdere se salsis Drogheda cernit aquis.”

The surrounding district, within a radius of some 20 miles, and the town itself, are full of interest to the archæologist and historian.

For the following information I am indebted to the late Dr. John Bellew Kelly, F.R.C.S.L., of Drogheda.

In consequence of its position the greater portion of the town is well protected from the chief winds. Those from the east however are not guarded against. The configuration of the surface of the ground in relation to drainage is satisfactory, as all drains must run into the river with a considerable fall of about 100 feet.

The borough is planted with trees to some extent, but without much regard to any possible modification of the climate being thereby induced. Vegetation is good.

The drainage has since 1870 been all remodelled and re-constructed, so that Drogheda is now one of the best-drained towns in Ireland. As regards the water supply, the Corporation have recently by Act of Parliament purchased the water company's powers, and are preparing to construct filter-beds and a greater storage, either by enlarging the present reservoirs or by making another one, which will leave the town with a never-failing supply of good water. Before the present drainage system was adopted and carried out there was a prevalence of zymotic disease, which now does not exist.

The climate of Drogheda is fresh and invigorating. The prevailing winds are from the south-west. The rainfall is not registered; fog is unknown. The winters are irregular and sometimes harsh; spring is wet; in summer excessive heat is often experienced, but the autumns are always genial.

CLOGHER.

Clogher is a fishing village situated about 7 miles north-east of Drogheda, and about 4 miles due north of the mouth of the river Boyne. The district is agricultural and of a high class: about three-quarters of a mile north-east of the village is a coast-guard station of modern construction. There is also a small harbour for fishing-smacks and boats. The Board of Works have recently laid out a considerable amount of money in the construction of a pier, which was intended to give shelter. To the south and east is a beautiful headland known as Clogherhead, stretching into the sea for about a mile and a half, the surface being fine grass with rocks cropping up frequently. The coast is rock-bound and bold: from the headland the view north and south is very fine.

Regarding the village, the upper or main portion of it is fairly well protected from winds, but the lower or south-east part is open to easterly winds. Want of protection from east winds also occurs in the case of the headland and the harbour, as the pier before referred to cannot be said to be the shelter it was evidently intended to be.

Configuration of surface in relation to natural drainage could not be more satisfactory. The elevation is at the most 160 feet or thereabouts. In Clogher and the district around there are no trees, but in other respects the vegetation is excellent.

The climate is extremely good all the year round, but while bracing, is genial from June to October or November, September being one of the pleasantest months, and March possibly the worst. The autumn is considered the pleasantest season for residence at Clogher. Humidity is low. The prevailing winds are from the south-west; there is constant sunshine.

The prevalence of disease is under the average; the inhabitants are healthy, strong and hardy, and live to a great old age.

Clogher is simply, as before stated, a fishing village, but could with enterprise and capital be turned into a health resort by building villas or terraces and generally encouraging visitors. With a view to this, the Great Northern Railway have arranged to run cheap excursions to the Head once each week.

CO. MEATH.

LAYTOWN.

Laytown proper is a small village situated at the mouth of the river Nany, about 5 miles south-east of Drogheda. It consists of a large hotel, a grocery establishment, some cottages and a coast-guard station, and extends for a mile and a half along a gradually sloping velvet strand running directly north. In addition there are several villas built at an elevation of about 35 feet above the sea, and these also are known as Laytown.

The geological formation is sand of a very light nature. The configuration for natural drainage is good; the elevation being from 35 to 40 feet. There is very little planting and practically no protection from wind, while to the east the place is completely exposed.

The prevailing wind during the winter, and possibly through the year, is from the south-west. Sunshine is frequent; fogs are almost unknown. Vegetation, except for the scarcity of trees, is exceedingly good.

The climate may be considered bracing, but it is often very hot from the middle of June to the middle of August.

The drainage is primitive. The water is derived from spring wells.

The inhabitants are exceptionally healthy and free from disease.

Laytown is a suitable summer resort for children requiring fresh air and sea-bathing.

THE MINERAL SPRINGS OF IRELAND

BY NORMAN MOORE, M.D., F.R.C.P.

THE mineral springs of Ireland are numerous and valuable, but their conveniences seem to have been but little developed since the time of Rutt¹. **Lucan, Leixlip, Mallow, Kilkee, Kinlough,** and **Dunkineely** are mentioned elsewhere in this volume. **Lisdoonvarna** however has attained sufficient reputation to require a full description.

LISDOONVARNA.

Lisdoonvarna, a townland in the parish of Kilmoon, barony of Burren and county of Clare, 8 miles from Ennistymon, which is at present the nearest railway-station, takes its name from an old earthwork called in Irish *Liosdaibhneach*, which was the stronghold of the *Ui Duibhdabhoireann*, a family of hereditary lawyers and judges who lived here in the fourteenth and fifteenth centuries. Several law treatises in the Irish language, and a Glossary written in 1569 in the hand of one of the family, are contained in a manuscript numbered Egerton 88 in the British Museum library. The hereditary professors of law were fond of discussing elaborate hypothetical cases, such as those of the trespasses of tame birds (*Breatha comaitheasa*), and of bees (*Bech bretha*), but no cases occur about mineral springs in the four volumes of the *Ancient Laws of Ireland* hitherto published, and the treatise *Coibnius uisei* (Vol. iv. p. 206), which is altogether on rights in relation to water, makes no allusion to the value or uses of medicinal springs. The Glossary of Domhnall

¹ *A Methodical Synopsis of Mineral Waters of Great Britain and Ireland*, by John Rutt, M.D. London, 1757.

O'Duibhdabhoireann, which is not confined to legal terms, contains no passage referring to such springs, though some mention of them might have been expected had the mineral springs on his family property been in use in the sixteenth century. The book called *Dinnshenchus*—a collection of stories relating to places throughout Ireland, of which the oldest existing manuscript was written about 1150—has no tradition pointing to the use of such springs. In the fifteenth century the family of *Oh Icidhe* (Anglice, *O'Hickey*) were famous as hereditary physicians in the district which includes Lisdoonvarna, and I have had the opportunity of examining their chief medical book written in 1420. It does not mention the spa, nor do any of the medical manuscripts in the Irish language now in the British Museum.

At the beginning of the last century the waters seem to have had some local reputation, and were examined in July 1740 by the well-known Charles Lucas (1713–1771). In June 1751 Sylvester O'Halloran of Limerick (1728–1807) visited the place, and communicated an account of it to Dr. John Ruttly of Dublin, who published it in his book *A Methodical Synopsis of Mineral Waters*, in 1757. The reputation of the spa has considerably increased during the last fifty years.

Lisdoonvarna, which I visited on August 18, 1896, is about three miles from the Atlantic coast in the north of Clare, and stands on high ground sheltered on the land side by a plateau several miles in extent covered with heather. Streams in deep narrow glens run near the village. The district has very few trees. Good mountain air and a peat soil, as well as air from the Atlantic, are all present. The district consists geologically of Upper Carboniferous rocks, shales corresponding to the Uvedale shales, and limestone. The shales which are uppermost contain iron pyrites, and their line of junction with the limestone may be distinctly seen in many places.

There are four springs. The most important is the **Gowlawn sulphur spa**. It is enclosed in a suitable house, and flows with great abundance. It is quite clear as it comes up, contains a large quantity of sulphuretted hydrogen, and is not at all purgative.

Its composition however varies slightly, and it is strongest after rainy weather. The exact result of the analyses made on various occasions will be found in the statement kindly submitted by

Dr. J. M. H. Munro of the Agricultural College, Downton, and appended to this Report. For the information thus afforded, including the results of his hitherto unpublished observations, the Committee desire to express to him their deep obligation.

The water of the spring is very cold, is diuretic and slightly constipating.

There are two baths for men and one for women. They are plain baths in which the water is warmed.

Patients drink from one to four pints of the water a day: and Dr. W. H. Stacpoole-Westropp, who showed me every courtesy, states that it is very useful in cases of atonic dyspepsia, of gastric catarrh and of gout. He thinks a purely balneological use of it in eczema and psoriasis is of little good, nor is inhalation found to be useful.

A small public garden surrounds the Gowlawn spa. A stream flowing by this leads into a deep narrow glen, on the north side of which is the **Twin spa**. It consists of a hollow in the side of the glen containing two excavations about seven and nine inches in diameter side by side. Into one a sulphuretted hydrogen water flows steadily, emerging from the shale. The other is said to have been chalybeate, but was not flowing at the time of my visit. A full analysis of the sulphur spring will be found in Dr. Munro's Report. There is no covering, nor any attendant, but a flagstone has been laid in front on which drinking glasses stand. On a steep hill above this spring there are at some distance a few houses, but none directly above the springs, which seem quite clear of any drainage contamination.

On the other side of the village are the **Iron wells**, two springs on a slope with cottages above, and called respectively the "**Rathbawn Chalybeate Well**," and the "**Rathbawn Magnesia Well**," though the latter is also in reality a chalybeate water. Their exact composition is considered in Dr. Munro's report. They are enclosed by iron gates, and tumblers are to be had hard by. A fifth well is in a grass hollow to the north of the village and is used to bathe ulcers, and is called the Copperas well. Its water contains calcium sulphate. It is never closed, and not easily accessible in wet weather.

There are three or four hotels besides many houses in which lodgings can be obtained. The standard of comfort is not at

present very high, nor are there many amusements. A good performer on the Irish pipes, and occasional fiddlers versed in the pleasing native music are the sole representatives of the concerts of foreign spas, but for outdoor excursions there is abundant opportunity. The cliffs of Moher, among the finest in Ireland, are within an easy drive, as are the winding road of Balhyvaughan with its beautiful views, the old cathedral village of Kilfenora, the ruins of Leimeneigh, and the abbey of Corcomroe.

The season lasts from May to October, and when its hotel accommodation is somewhat developed Lisdoonvarna will be a summer and autumn residence of the highest health-giving value, combining fresh mountain air with the therapeutic advantages of a sulphur spring. It may be regarded as joining many of the advantages of Harrogate to those of Strathspey.

Besides the information given me by Dr. Westropp I made special inquiries as to patients, of Dr. George Macnamara of Corofin, and of Drs. Faris, Gelston, Greene of Ennis, all of whom had had experience of the effects of treatment there on patients of their own. They were unanimous as to the use of the locality and the sulphur spa in cases of dyspepsia, and in the conditions due to alcoholism and to sedentary life.

It seems to have been useful to a less degree in gouty affections, and in some cases of severe chronic arthritis.

REPORT ON THE CHEMICAL COMPOSITION OF THE LISDOONVARNA SPRINGS.

By J. M. H. MUNRO, D.Sc., F.I.C., F.C.S.

The principal springs at Lisdoonvarna are :—

1. The Gowlawm Sulphur Well.
2. The Twin Sulphur Well.
3. The Rathbawn Chalybeate Well.
4. The Rathbawn "Magnesia" Well (in spite of its name really a mild chalybeate water).

1. Of these the **Gowlawn Sulphur Well** is by far the most important. This water was analysed by Dr. Apjohn in 1855, by Messrs. Studdert and Plunkett in 1874, and by myself in 1889 and subsequently. These analyses are compared as regards the fixed ingredients in the following table :—

GOWLAWN SULPHUR WATER.

	GRAINS PER GALLON.		
	Apjohn, 1855.	Studdert and Plunkett, 1874.	Munro, 1889.
Sodium carbonate ...	6.210	7.161	3.910
Calcium carbonate ...	4.190	6.125	7.038
Magnesium carbonate ...	6.468	4.207	5.483
Sodium chloride ...	3.093	3.108	3.560
Potassium chloride ...	0.726	0.399	0.290
Lithium chloride ...	—	trace	trace
Calcium sulphate ...	2.856	0.567	0.782
Magnesium sulphate ...	—	0.420	—
Strontium sulphate ...	—	—	trace
Silica ...	0.710	0.952	0.899
Alumina and phosphates ...	0.230	—	0.182
	24.483	22.939	22.144

Although, following the older analyses, I have reported the soda, lime, and magnesia as carbonates, it is to be noted that they are present as bicarbonates in the water before evaporation. The water as it issues from the spring gives no colour with phenolphthalein, and affects litmus only after long contact, but after boiling it acquires a strong alkaline reaction to both indicators. The free carbonic acid, determined at the well on August 29, 1889, amounted to 10.72 grains per gallon, or more than enough to convert the carbonates into bicarbonates. The temperature of the spring taken on August 31, 1890, was 11.0° C., or really the same as that found by Studdert and Plunkett sixteen years before.

Messrs. Studdert and Plunkett recognized by the spectroscope traces of lithium in this water: this I was able to confirm, and by the same instrument I found traces of strontium also. As regards the most important ingredients of the spring—sulphuretted hydrogen and alkaline sulphhydrates—the information in the older analyses is meagre and somewhat conflicting. Dr. Apjohn (1855) reports 10.541 cubic centimetres of sulphuretted hydrogen per litre determined by precipitation at the well, 5.695 c.c. remaining in the water after transport to Dublin in a stone jar, and 0.27 c.c. present as metallic sulphide after transport to Dublin.

Messrs. Studdert and Plunkett (1874) report 5.553 cubic centimetres sulphuretted hydrogen per litre, but give no details as to the sample or method of determination.

On my visit in 1889 I availed myself of the facilities afforded by Dr. Stacpoole-Westropp to make a long series of determinations, extending over several weeks, of the actual strength in sulphuretted hydrogen of the water as delivered to the consumers in the Pump Room. I found this to be subject to remarkable variations, the minimum of over fifty estimations by the volumetric iodine-process giving 2.30 cubic centimetres per litre, the maximum 5.83, and the mean 4.14. These variations bore no relation to rainfall or weather, and the idea to which Messrs. Studdert and Plunkett give currency in their paper, viz. that rainy weather has the effect of diluting the Gowlna spring, was not in the least borne out by any observations I was able to make. In point of fact the highest determination of the series was made after a day and night of exceptionally heavy rain. Wishing to test the question of surface water gaining access to the Gowlna spring, I made a series of colorimetric comparisons by Lovibond's Tintometer of the Gowlna water with that of the little limestone river (Aille) and the peaty mountain stream which join near the Gowlna spring. The result of these and other experiments was to show that the Gowlna spring is entirely unaffected by surface water.

The variation in strength of sulphuretted hydrogen as delivered in the Pump Room I put down to loss of that gas by diffusion into the air from the water accumulated in the well and in course of delivery by the pump. Thus the water was always strongest when the stream of drinkers was greatest, *i.e.* when the water was pumped from the well nearly as fast as it was supplied by the spring, a pause of even half-an-hour being sufficient to cause a notable falling off in the strength. At this time the well was about 5 ft. deep, loosely covered, and containing 3 ft. of water from inlet to overflow. The pump was an old-fashioned one quite open to the air above the plunger, and with an open spout. Samples of water taken from the bottom of the well were near the maximum strength recorded above, but I came to the conclusion that neither this figure nor that of Studdert and Plunkett represented the real strength in sulphuretted hydrogen of the spring. When the springs were taken over by the Lisdoonvarna Improvement Committee I placed these views before them, and when the Pump Room was enlarged the well was properly closed in and fitted with suitable pumps allowing no contact with the air until the water reached the consumer's

glass. Being anxious to see how these improvements affected the strength of the water, on a subsequent visit in Sept. 1893, I experimented on methods of preserving the water for transport without loss of sulphuretted hydrogen. Having succeeded in effecting this, I bottled some water at the well for examination on my return to England, and this water examined four months later contained 7.54 cubic centimetres of sulphuretted hydrogen per litre, thus proving at once the success of the preserving process and the great gain in the strength of the water due to improvements effected at the well.

The sulphur of the Gowlawm spring is nearly, but not quite, all present as free sulphuretted hydrogen. After expulsion of the sulphuretted hydrogen by prolonged boiling or by a current of hydrogen gas, there remains a little alkaline sulphhydrate precipitable by cadmium chloride; and after complete removal of free sulphuretted hydrogen and alkaline sulphhydrates from the water by precipitation with cadmium, there is still a little action on standard iodine possibly due to a trace of thiosulphate. Different determinations of these ingredients vary, but generally perhaps 0.5 c.c. of the total sulphuretted hydrogen per litre may be accounted for in these forms.

2. Twin Sulphur Spring.—This occurs in the form of a small stream issuing directly from the wall of limestone rock bounding the river some distance below the Gowlawm spring. It derives its name from the remarkable circumstance of being *one* of two such springs issuing at only a few inches distance from each other, but, strange to say, the second spring is chalybeate, and contains totally different and indeed incompatible minerals. This iron spring had ceased to flow before the date of Studdert and Plunkett's visit, but they made the following observations on the Twin Sulphur Spring:—

Temperature	...	...	...	11.6° C.
Rate of flow	...	...	...	1 litre in 1 minute 20 seconds.
Sulphuretted hydrogen...	...	...	...	2.052 c.c. per litre.

Sixteen years later (1889) I found the temperature to be 11.3° C., rate of flow¹ 1 litre in 1 minute 18 seconds, and sulphuretted

¹ This refers to the stream which issues clear of the rock: as this is reinforced by streams trickling down the rock, the basin below fills at the rate of about half-a-gallon per minute.

hydrogen (mean of five determinations) 2·35 cubic centimetres per litre. It is evident that this spring, although small, is of remarkable constancy. The saline ingredients are as under :—

	Grains per gallon.
Sodium carbonate	4·126
Calcium carbonate	10·431
Magnesium carbonate	8·324
Sodium chloride	3·414
Potassium chloride	0·279
Lithium chloride	trace
Calcium sulphate	0·143
Strontium sulphate	trace
Alumina and phosphates	0·210
Silica	1·296
	<u>28·523</u>

The sodium, calcium, and magnesium carbonates are present in the fresh water as bicarbonates. The mineral ingredients of this spring resemble those of the Gowlnaun, including decided traces of lithium and strontium, but the water is much less strongly charged with sulphuretted hydrogen.

3. The Rathbawn Chalybeate Well.

The following table gives the result of the analysis of this water made by Studdert and Plunkett, and myself :—

	GRAINS PER GALLON.	
	Studdert and Plunkett, 1874.	Munro, 1880.
Silica	0·847	1·015
Ferrous carbonate	2·219	2·125
Ferric oxide	0·189	—
Total iron	(1·197)	(1·026)
Manganese carbonate	0·119	0·026
Calcium carbonate	9·800	7·239
Magnesium carbonate	0·665	3·175
Calcium sulphate	5·901	7·871
Magnesium sulphate	5·880	—
Sodium chloride	3·647	3·225
Potassium chloride	0·448	0·242
	<u>29·715</u>	<u>24·918</u>

The carbonates are present as bicarbonates in the fresh water. The quantity of iron is subject to slight variation, determinations which I made at different times giving from 0.776 to 1.116 grains of metallic iron per gallon. Following a suggestion of Dr. Stacpoole-Westropp I searched for traces of arsenic in this water, but without result.

4. The Rathbawn Mild Chalybeate, or "Magnesia" Well.—Messrs. Studdert and Plunkett determined the iron in this water as 0.504 grain per gallon, equal to 1.043 grains ferrous carbonate. They refer to the well as having fallen into disuse, but this is a mistake. It is probably indeed consumed in larger quantities than any of the other Lisdoonvarna waters, for it is placed on the hotel and boarding-house tables as a table-water for use at meals. A sample examined by me (1889) contained 31.0 grains total solids per gallon, these consisting of the same ingredients as the strong Rathbawn Chalybeate, including a weighable quantity of manganese, sodium chloride 6.44 grains per gallon, and calcium sulphate 6.05 grains per gallon. A full analysis was not made as this water was found to be very variable in composition. Thus the iron amounted to .558, .542, and .594 grain per gallon when the water appeared to be normal in composition, but on some occasions was very much less than this, falling even as low as .077 grain.

5. The small Chalybeate spring, just below the church, now used instead of the "Twin" Chalybeate spring, is a weak iron water, containing, on the occasions when I tested it, quantities of iron ranging from 0.15 to 0.23 grain per gallon.

INDEX

- ABBEY WOOD**, Plumstead, S.E., surface geology and altitude, 79
- Aberaeron**, 374
- Aberdovey**, bronchitis benefited at, 326
drainage and water supply, 326; mildness of climate, 325
- Aberffraw**, 318
- Abergele**, 303
- Aberporth**, 374
- Abersoch**, drainage and water supply, 319
- Aberystwith**, 374-379; anæmia and debility prevalent, 377; asthma frequent among visitors, 378; bronchitis and catarrh common, 377; climate, 377; diarrhoea in summer, 378; drainage, 379; meteorological tables, 376; most common causes of death, 379; neuralgia (facial) common, 378; phthisis not uncommon, 377; pneumonia and pleurisy rare, 377; renal diseases rare, 378; rheumatism and arthritis rare, 378; scarlet fever, diphtheria, rare, 378; scrofula, amount of prevalence, 377; skin diseases, amount of prevalence, 378; tubercular diseases benefited at, 377; sore throats (endemic), 378; typhoid fever rare, 378; vital statistics, 378; water supply, 379
- Abney Park**, surface geology and altitude, 77, 80
- Achill Island**, 520; climate, 521
and Doogort, albuminuria (chronic) rare at, 522; anæmia and debility rare, 522; asthma rare, 522,—benefited at, 522; bronchitis, amount of prevalence, 522; calculus and gravel unknown at, 522,—benefited at, 522; catarrh, amount of prevalence, 522; causes of death, 522; climate, 523; diarrhoea rare at, 522; diphtheria very rare at, 522; drainage, 523;
- Achill Island and Doogort**—*continued*.
dropsy (acute renal), amount of prevalence, 522; malarial affections absent, 522; neuralgia benefited at, 522; old age prevalent, 522, 523; phthisis rare at, 522; pleurisy, amount of prevalence, 522; pneumonia, amount of prevalence, 522; rheumatism, not suitable for, 522; rheumatoid arthritis prevalent at, 522; scarlet fever, amount of prevalence, 522; scrofula and tuberculous diseases rare, 522; skin diseases absent, 522; sore throat (endemic) prevalent, 522; typhoid fever rare, 522; water supply, 523
- Acton, W.**, surface geology and altitude, 75, 77, 80
- Acton Spa** (ancient), saline, 43
- Adderley**, Dr. John, notes on Glengariff, 467
- Addington, Surrey, S.**, surface geology and altitude, 74, 75
- Addiscombe**, surface geology and altitude, 75, 79
- Adenitis** (tuberculous), benefited by Blackpool, 189
- Adenoids**, benefited at Blackpool, 189; at Malvern, 143; rare at Malvern, 143
- Adolescents**, climate of Cheltenham less suitable for the young, 152
- Age** (old):
benefited at Leamington, 159; at Tenby, 363
common in Achill Island and Doogort, 522, 523; at Ardglass, 564; at Buncrana, 537; at Clogher (Co. Down), 576; in Cork, 452; at Felixstowe, 93; at Galway, 506; at Glengariff, 466; at St. David's, 369; at Southwold, 99; at Tenby, 362; at Valentia Island, 486

Age cold—continued.

distribution, in Northumberland, Durham and Yorkshire, 274,—in Lake District, 213
rare in Belfast, 355

Aghada, 459

Ague, *see* Malaria

Air of London, 20,—carbonic acid in, 25,—composition and impurities, 20,—local differences in purity, 22; of Manchester and Salford, 22

Albuminuria:

benefited at Tenby, 363
prevalent in Belfast, 555; at Cromer, 110; at Fishguard, 371; at Woburn Sands, 162

rare at Achill Island and Doogort, 522; at Ardglass, 563; at Cheltenham, 150; at Clacton-on-Sea, 88; at Colwyn Bay, 308; at Galway, 506; in Lake District, 212; at Pwllheli, 320; at St. David's, 368; at Valentia Island, 485

Alcoholism, bad effects of, benefited by Gowllawn Sulphur Well (Lisdoonvarna), 581; prevalent in Lake District, 213

Aldeburgh, 91; anæmia benefited at, 94; bronchitis prevalent at, 94; calculus and gravel almost unknown at, 94; debilitating diseases, benefited at, 94; rheumatism prevalent at, 94

Aldenham, surface geology and altitude, 78

Alderham, N.W., surface geology and altitude, 74

Alderson's analysis of Shap Wells, 220

Alexandra Park, N., surface geology and altitude, 77

Alluvium or marshland districts in the County of London and Greater London, 74

Alnmouth, 258

Alnwick, 258; meteorological tables, 256, 277

Alpertown, N.W., surface geology and altitude, 77

Alston, meteorological tables, 225

Altadore Sanatorium, 427

Altitude, high, unfavourable to rheumatism, 71

Altitudes (of Greater London), 7; index to surface geologies and altitudes, 73-80

Amberley as a residence for visitors to Minchinhampton Common, 154; drainage of, 154

Ambleside, 218

Anæmia:

absent at Tramore, 439
benefited at Aldeburgh, 94; at

Anæmia—continued.

Ascot, 164; at Cromer, 110; by East Coast, 86; by Flitwick chalybeate water, 173; in Isle of Man, 224; at Lowestoft, 105; at Malvern, 113; at Tenby, 363; at Tramore, 439; at Trefriw, 328

not benefited at The Mumbles, 355; at Northumberland, Durham and Yorkshire coast resorts, 275

amount of prevalence at Aberystwith, 377; in Fishguard district, 371; at Leamington, 158; at Swansea, 351

prevalent at Belfast, 555; at Cheltenham, 150; in Cork and neighbourhood, 450; at Galway, 505; at Glengarriff, 467; in Lake District, 211; in Lynn and Lynn district, 118; in Northumberland, Durham and Yorkshire, 270, 271; at Southwold among natives, 98; at St. David's, 368

uncommon at Achill Island and Doogort, 522; at Ardglass, 562; at Beaumaris, 316; at Cromer, 110; at Felixstowe, 92; in Isle of Man, 224; at Lowestoft, 105; at Pwllheli, 320; at Tenby, 362; at Valentia Island, 485; at Woburn Sands, 162

Analysis of Copperas Well (Lisdoonvarna), 586; of Flitwick Chalybeate Water, 172; of Gowllawn Sulphur Well (Lisdoonvarna), 582; of Rathbawn Chalybeate Well (Lisdoonvarna), 585; of Rathbawn Mild Chalybeate or "Magenesia" Well (Lisdoonvarna), 586; of Shearsby Spring, 173; of Trefriw Springs, 327; of Tunbridge Wells Chalybeate Water, 327; of Twin Sulphur Well (Lisdoonvarna), 584, 585

Anascaul, 439

Anerley, S., surface geology and altitude, 77

Aneurysm, very rare in Lake District, 213

Anglesey, mild in winter: exposed to winter winds, 316; water supply in villages, 317; *see also* Aberffraw, Beaumaris, Bull Bay, Cemmaes Bay, Holy Island, Malldraeth, Red Wharf Bay, Rhoscolyn, Rhosnegir

Anglo-Indians benefited by residence at Cheltenham, 151

Antrim (County). *See* Ballycastle, Carnlough, Carrickfergus, Cushendall, Cushendun, Garron Tower, Glenarm, Larne, Portrush, Rathlin Island, Whitehead

- Apjohn, Dr., former analysis (1855) of Gowlawn Sulphur Well (Lisdoonvarna), 581
- Appleby, rainfall table, 207
- Apsley (Guise), 159; *see also* Woburn Sands; meteorological tables, 160, 161
- Ardglass, 561-564; albuminuria (chronic), rare at, 563; anæmia and debility rare at, 562; asthma rare at, 563; bronchitis prevalent at, 563; broncho-pneumonia prevalent at, 563; calculus and gravel rare at, 563; causes of death, 564; diarrhoea rare at, 563; diphtheria rare at, 564; drainage, 564; dropsy (acute renal), rare at, 563; eczema rare at, 563; malarial affections absent at, 563; neuralgia prevalent at, 563; old age prevalent, 564; phthisis, amount of prevalence, 562; phthisis in summer, benefited by, 562; pleurisy rare at, 563; pneumonia rare at, 563; rheumatism and rheumatoid arthritis common at, 563; scarlet fever rare at, 563; scrofula rare at, 562; skin diseases rare at, 563; tuberculous diseases rare at, 562; typhoid fever rare at, 563; water supply of, 564
- Ardmore, 441
- Arklow, 430; *see also* Vale of Ovoca
- Arnside, 201
- Arran Islands, 503, 504; typhus fever, amount of prevalence, 504
- Arteries (rigid calcareous), uncommon in Lake District, 213
- Arthritis (rheumatoid):
 amount of prevalence at Cardiff, 343;
 at Galway, 506
 benefited by Gowlawn Sulphur Well (Lisdoonvarna), 581; by Malvern, 143
 not benefited at Colwyn Bay, 308;
 in Isle of Man, 224
 prevalent at Achill Island and Doogort, 522; at Ardglass, 563; in Belfast, 553; in Fishguard district, 372; in Lake District, 212; at St. David's, 368; at Southwold, 99
 uncommon at Aberystwith, 378; at Carmarthen, 360; at Clacton-on-Sea, 89; at Cromer, 110; at Felixstowe, 93; at Llandudno, 312; at Tenby, 362; at The Mumbles, 355; at Woburn Sands, 162
- Artificial characters of London district most distinctive and important, 3
- Ascot, 163-165; anæmia benefited at, 164; bronchitis benefited at, 164;
- Ascot—*continued*.
 climate, 164; climate of district around not equally favourable, 164; debility benefited at, 164; drainage (artificial), 164; (natural), 163; phthisis benefited at, 164; soil, 163; water supply, 164
- Ashford, W., surface geology and altitude, 75
- Ashtead, S.W., surface geology and altitude, 74, 79
- Asthma:
 benefited at Achill Island and Doogort, 522; at Enniskerry, 420; at Llandudno, 313; at Malvern, 143, 144; at Southwold, 99; at Swansea, 352; at Tenby, 363; at Woburn Sands, 162
 not benefited at Beaumaris, 317; at Dovercourt, 90; at Enniskerry, 525; in Lake District, 217; at Rhyl, 302
 amount of prevalence at Aberystwith, 377, 378; in Belfast, 555
 prevalent in Cork and neighbourhood, 451; at Criccieth, 321; in Lake District, 212; at Nevin, 319; in Northumberland, Durham and Yorkshire, 271
 rare at Achill Island and Doogort, 522; at Ardglass, 563; at Barmouth, 324; at Buncrana, 537; at Carmarthen, 359; at Cheltenham, 150; at Clacton-on-Sea, 88; at Colwyn Bay, 308; at Cromer, 110; in Fishguard district, 371; at Galway, 506; at Leamington, 158; at Malvern, 143; at Southwold, 99; at St. David's, 368; at Tenby, 362; at Valentia Island, 485; at Woburn Sands, 162
- Atmosphere; *see* Air
- Autumn, climate of Northumberland, Durham and Yorkshire during, 252-254; Clogher (Co. Down), health resort for autumn months, 576; Lisdoonvarna, health-giving summer and autumn residence, 581; phthisis (early) said to benefit on Yorkshire coast in summer and early autumn, 275
- Aysgarth, meteorological table, 256, 280
- BAGNIGGE WELLS (ancient), saline and purgative, 42
- Bagshot Beds, in County of London and Greater London, 79
- Bakewell, climate relaxing, 170
- Balbriggan, 408; meteorology of, 408
- Balham, S., surface geology and altitude, 75, 77, 80

- Ball, Sir R., F.R.S., on the Cloghvorra Stone, Kenmare, 470
- Ball Bay, 317
- Ballina, 524
- Balls Pond, N., surface geology and altitude, 80
- Ballybrack, 414
- Ballybunion, 491
- Ballycastle, 547; sea-bathing good, 547
- Ballycotton, 445
- Ballyvaughan, 502
- Baltimore (Co. Cork), 462
- Bamburgh, 259; drainage, 259; water supply, 259
- Bangor (Ireland), 557
- Bangor (North Wales), mild in winter; exposed to cold damp winds, 316
- Banstead, S.W., surface geology and altitude, 74
- Bantry, 463
- Barking, E., surface geology and altitude, 75
- Barmouth, asthma rare at, 324; bronchitis and phthisis benefited at, 324; bronchitis and catarrh, amount of prevalence at, 324; climate, 323; convalescence promoted at, 324; drainage and water supply, 324; hæmoptysis rare, 324; phthisis rare, 324; rainfall heavy, 324; rheumatism rare, 324; tubercular diseases rare, 324; typhoid fever very rare, 324
- Barna, 507
- Barnard Castle, 262, 263
- Barnes, S.W., surface geology and altitude, 75, 80
- Barnesbury, N., surface geology and altitude, 75
- Barnet, N., surface geology and altitude, 77, 78
- Barnet, East, N., surface geology and altitude, 77, 78
- Barnet, New, N., surface geology and altitude, 77
- Barometric pressure, Durham, 256, 257; Northumberland, 256, 257; Yorkshire, 256, 257
- Barrow, rainfall table, 209
- Barter, Dr., founder of St. Ann's Hill Hydropathic Establishment in 1843, 454
- Barton, Dr. Samuel, notes on prevalence of disease at Cromer, 110
- Baths at Glenbrook, 455; at Saltburn, 265; (public baths) and washhouses in London, 43-45
- Baths and spa-house erected at Mallow in eighteenth century by Sir Denham Norreys, 453
- Battersea, crude and corrected death-rates, 53; death-rate from phthisis, 60; dwellers in inferior tenements exposed to rheumatism, 68; healthy for dwellers in high flats, 68; surface geology and altitude 75-80
- Bayswater, surface geology and altitude, 75, 77, 80
- Beaumaris, anæmia uncommon at, 316; asthma not benefited, 317; climate of, 316; diphtheria rare, 317; drainage and water supply, 317; hæmoptysis, amount of prevalence, 316; kidney diseases rare, 316; lung diseases rare, 317; phthisis rare at and benefited at, 316; typhoid and scarlet fever rare, 317
- Beckenham, S.E., surface geology and altitude, 79
- Beckenham (South), S.E., surface geology and altitude, 76, 78
- Beckton, E., surface geology and altitude, 74
- Beddington, S., surface geology and altitude, 74-79
- Bedford Park, W., surface geology and altitude, 80
- Beech Hill Park, Enfield, surface geology and altitude, 75
- Beever, Sir Hugh, on phthisis in South Wales, 380
- Belfast, 553-556; albuminuria (chronic), prevalent, 555; anemia prevalent, 555; asthma, amount of prevalence, 555; bronchitis and catarrh prevalent, 555; calculus and gravel rare in, 555; debility prevalent, 555; diarrhœa prevalent, 555; diphtheria, increasing, 555; drainage, 553; dropsy (acute renal) rare in, 555; geology of district, 554; hæmoptysis prevalent, 555; malarial affections absent, 555; mortality in 1899, 555; neuralgia prevalent, 555; old age not prevalent, 555; phthisis prevalent, 555; pleurisy prevalent, 555; pneumonia, amount of prevalence, 555; rainfall, 555-556; rheumatism prevalent, 555; rheumatoid arthritis prevalent, 555; scarlet fever prevalent, 555; scrofula prevalent, 555; skin diseases rare, 555; sore throat (endemic) prevalent, 555; surface and area, 554; tuberculosis prevalent, 555; typhoid fever prevalent, 555; water supply, 553
- Bellarena, 542; rainfall, 542
- Belmullet, 523; meteorological table, 519
- Belper, climate relaxing, 170; meteorological tables, 169

- Belsize Park, N.W., surface geology and altitude, 77
- Belvedere, Erith, S.E., surface geology and altitude, 74, 79
- Bentley Priory, N.W., surface geology and altitude, 78
- Bermondsey, S., crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 74
- Bermondsey Spa (ancient), chalybeate, 43
- Berwick-on-Tweed, with Tweedmouth and Spittal, 258
- Betchworth, surface geology and altitude, 75, 79, 80
- Bethnal-Green, crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 80
- Bettws-y-coed, 326
- Beulah Hill, S., surface geology and altitude, 77
- Beulah Spa (ancient), muriated and sulphuretted waters, 43
- Bevan, Dr., notes on The Mumbles, 355
- Bexley, S.E., surface geology and altitude, 75
- Bexley Heath, S.E., surface geology and altitude, 79
- Bickley, S.E., surface geology and altitude, 79
- Bidfont, East, W., surface geology and altitude, 75
- Bishop Wearmouth, 261
- Blackfriars, surface geology and altitude, 77
- Blackheath, S.E., as a residence, 68; metropolitan health resort, 72; rheumatism benefited at, 72; surface geology and altitude, 79
- Blackheath beds, in County of London and Greater London, 79
- Blackpool, 188, 189; adenitis (tuberculous) benefited at, 189; adenoids benefited at, 189; bronchitis not benefited at, 189; heart disease of certain kinds not benefited at, 189; kidney diseases not benefited at, 189; meteorological tables, 193; phthisis not benefited at, 189; skin diseases of certain kinds not benefited at, 189; undesirable for invalids in summer months, 189
- Blackwall, surface geology and altitude, 75
- Blackwater, 432
- Blackwater (River), 442
- Blarney, 454; St. Ann's Hill Hydro-pathic Establishment, 454
- Bloomsbury, surface geology and altitude, 75, 80
- Bolton, meteorological tables, 194
- Bones (tuberculosis of), benefited at Douglas, Isle of Man, 224
- Bonnmahon, 440; connection of Sir Patrick Dun with, 440
- Boosterstown, 409
- Boreham Wood, surface geology and altitude, 77
- Borth, 323
- Bostal Heath, S.E., surface geology and altitude, 79
- Boulder clay districts in the County of London and Greater London, 74
- Bounds Green, Colney Hatch, N., surface geology and altitude, 77
- Bow, E., 71; surface geology and altitude, 75
- Bowes Park, N., surface geology and altitude, 77
- Bowness-on-Windermere, 218
- Boyle, Hon. Robert, one of founders of Royal Society, born at Lismore, 445
- Bracelet Bay, 356
- Bracing health resorts of Ireland, 388
- Bradford, meteorological tables, 256, 282
- Bray, 418; drainage, 419; rainfall, 419
- Brent: pollution of river Brent by sewage, 41-50
- Brent Valley, N.W. and W., surface geology and altitude, 75
- Brentford, surface geology and altitude, 80
- Brentwood, surface geology and altitude, 75
- Brick-earth: valley brick-earth or loam districts in County of London and Greater London, 80
- Bridlington, 268; drainage, 268
- Bright's disease benefited at Morecambe and Grange, 189; at Southport, 190
- Brine baths obtainable at Malvern by importation of Droitwich brine, 144
- Bristol, climate of, 152
- Brixton, S., as a residence, 68; surface geology and altitude, 75, 77
- Brixton Hill spring (ancient), bromo-ioduretted water, 43
- Broadhaven, 365
- Brockatt, Dr. Andrew, report on prevalence of diseases in Malvern, 143
- Brockley, surface geology and altitude, 77
- Brockwell Park, S.E., surface geology and altitude, 77, 79
- Bromley, Kent, S.E., surface geology and altitude, 79
- Bromley (Bow), E., surface geology and altitude, 75
- Bromo-ioduretted waters (ancient), Brixton Hill, 43

- Brompton, S.W., bronchial affections benefited at, 72; favourable to rheumatism, 71; surface geology and altitude, 75
- Bronchial affections benefited at Brompton, 72; at South Kensington, 72; at West Kirby, 191
- Bronchitis :
 benefited at Aberdovey, 326; at Ascot, 164; at Barmouth, 324; at Cheltenham, 152; at Colwyn Bay, 308; at Felixstowe, 93; at Mallarmy, 518; at Morecambe and Grange, 189; at Pyllheli, 321; at Southport, 190; at Weybridge (pine districts), 72; at Woburn Sands, 162; at Woking (pine districts), 72
 not benefited at Blackpool, 189; at Hoylake in winter and early spring, 191; at The Mumbles, 355; at Wells-next-the-Sea, 112
 death-rate from, in London County, 1899, 59
 mortality tables of, at Carmarthen, 359
 amount of prevalence at Aberystwith, 377; at Achill Island and Doogort, 522; at Barmouth, 324; at Cardiff, 313; at Carmarthen, 359; at Cheltenham, 150; in Fishguard district, 371; at Galway, 506; at Pwllheli, 320
 prevalent at Aldeburgh, 94; at Ardglass, 563; in Belfast, 555; in Cork and neighbourhood, 450; at Criccieth, 321; at Cromer, 110; in Dublin, 396; in Lake District, 212; at Leamington, 158; in Northumberland, Durham and Yorkshire, 270; at St. David's, 368; at Swansea, 352; at Tenby, 362
 uncommon at Buncrana, 537; at Clacton-on-Sea, 88; at Enniscrone, 525; at Llandudno, 312; at Malvern, 143; at Valentia Island, 485; at Woburn Sands, 162
- Broncho-pneumonia, influenzal in nature, prevalent at Ardglass, 563
- Brondesbury, N.W., surface geology and altitude, 77
- Brook Green, W., surface geology and altitude, 80
- Brooksbank, Dr. H. L., the climate of the Lake District, 195-229
- Brownwood Park, surface geology and altitude, 77
- Bruce Grove, Tottenham, surface geology and altitude, 75, 77
- Buckhurst Hill, N.E., surface geology and altitude, 78
- Buckley, Dr. H. C., notes on Llanelly urban district, 359
- Building, mist in London diminished by, 33
- Bull Bay, 317
- Buncrana, 536-538; asthma rare at, 537; bronchitis and catarrh rare at, 537; calculus and gravel absent at, 537; climate, 536; drainage, 537; geology, 537; hæmoptysis rare at, 537; kidney diseases rare at, 537; old age prevalent, 537; phthisis not uncommon at, 537; pleurisy and pneumonia prevalent at, 537; scrofula rare at, 537; tuberculous diseases (except phthisis) rare at, 537; typhoid fever rare at, 537; water supply, 537
- Bundoran, 531
- Bunhill Row (London), sunshine tables, 176
- Burghill, meteorological tables, 183
- Bush Hill Park, Enfield, surface, geology, and altitude, 77
- Buxton, 166; meteorological tables, 167, 168; meteorology, 166; a summer health resort principally, 166; temperature (mean minimum) of winter lower than at any other English station, 166
- CAHIRCEVEEN, 486
- Calcium chloride, a principal ingredient of Shap Wells, 220
- Calculi (biliary), prevalent in district round Windermere, 213
- Calculus :
 absent at Achill Island and Doogort, 522; at Aldeburgh (almost), 94; at Buncrana, 537; at Cheltenham (almost), 150; in Cork and neighbourhood, 451; at Leamington, 158; at Valentia Island, 485
 benefited at Achill Island and Doogort, 522; at Cheltenham, 150
 amount of prevalence and distribution in Norfolk, 115-117
 prevalent at Cromer, 110; in Lynn district in some areas, absent in others, 115
 rare at Ardglass, 563; in Belfast, 555; at Clacton-on-Sea, 88; at Galway, 506; in Lake District, 212; at Malvern, 143; in North-

Calculus—*continued*.

umberland, Durham and York-
shire, 270 ; at Woburn Sands, 162
Camberwell, crude and corrected death-
rates, 53 ; death-rate from phthisis, 60 ;
surface geology and altitude, 75
Cambridge, meteorological tables, 186 ;
sunshine tables, 174
Cambridge Heath, surface geology and
altitude, 75
Camden Town, N., as a residence, 70 ;
surface geology and altitude, 77
Campden Hill, surface geology and
altitude, 75, 77, 80

Cancer :

death-rate in London County (1851-
1899), continuous increase, 59 ; in
Midland Counties, 134, 135
increasing at Swansea, 353
mortality in England and Wales, 63 ;
in Essex, 63 ; in Kent, 63 ; in
London County, 63 ; in Middle-
sex, 63 ; in Surrey, 63 ; in Sussex,
63

prevalent in Eden Valley (Lake
District), 199 ; at Portmadoc, 322
Canning Town, E., surface geology and
altitude, 75

Capoquin, 444

Caragh Lake, 487-489 ; climate of dis-
trict, 489

Carbonic acid in London air, 24 ; in
Manchester air, 25 ; ingredient of
Kilkee Spa, 499

Carbonic acid and sulphuric acid, most
injurious constituents of smoke, 30

Carbuncles, prevalent in district round
Windermere, 213

Cardew, Mr. G. A., reports on prevalence
of disease at Cheltenham, 150

Cardiff, anæmia, amount of prevalence at,
341 ; causes of death, 346 ; chlorosis,
amount of prevalence at, 341 ; death-
rate from anæmia, 341,—from bron-
chitis, pneumonia, and pleurisy, 343,
—from diphtheria, 346,—from leucocy-
thæmia, 341,—from phthisis, 342,—
from scarlet fever, 345,—from typhoid
fever, 344 ; diarrhoea, amount of preva-
lence at, 344, 345 ; diphtheria preva-
lent, 346 ; drainage, 346 ; kidney
diseases, amount of prevalence at, 343 ;
leucocythæmia, amount of prevalence
at, 341 ; meteorological tables, 341 ;
neuralgia, amount of prevalence at,
343 ; phthisis decreasing, 342, 348 ;
rainfall, 341 ; rheumatism, amount of
prevalence at, 343 ; scarlet fever de-
creasing, 345, 348 ; scrofula, amount of

Cardiff—*continued*.

prevalence at, 341 ; temperature in the
four seasons, 340 ; tubercular diseases,
amount of prevalence at, 341 ; typhoid
fever rare at, 343, 344 ; water supply
and analysis of water, 346-348

Cardonagh, 538

Caries (dental), prevalent in Lake Dis-
trict, 213

Carlingford, 572

Carmarthen, anæmia and debility,
amount of prevalence at, 359 ; asthma
rare at, 359 ; diarrhoea very prevalent
at, 360 ; diphtheria very rare at, 360 ;
drainage, 360 ; endemic sore throat
absent at, 360 ; hæmoptysis prevalent
at, 359 ; kidney diseases uncommon
at, 360 ; meteorological tables, 358,
359 ; mortality tables of bronchitis
and catarrh, 359,—of phthisis, 359,—
of pneumonia, 359 ; neuralgia preva-
lent at, 360 ; pneumonia, amount of
prevalence at, 359 ; rheumatism preva-
lent at, 360 ; scarlet fever common at,
360 ; skin diseases and eczema, amount
of prevalence at, 360 ; tubercular dis-
eases, amount of prevalence at, 359 ;
typhoid fever endemic at, 360 ; water
supply, 360

Carnalea, 556

Carnlough, 550

Carrickfergus, 552 ; rainfall, 552

Carshalton, S., surface geology and alti-
tude, 74, 79

Castle Hill and Castle Bar, Ealing, sur-
face geology and altitude, 75, 77

Castle Rock, 543

Castletownshend, 461 ; rainfall at, 462

Caswell Bay, winter resort for phthisical
patients, 355, 356

Catarrh :

benefited at Colwyn Bay, 308 ; at
Malvern, 143
not benefited at The Mumbles, 355
mortality tables at Carmarthen,
359
amount of prevalence at Aberystwith,
377 ; at Achill Island and Doog-
ort, 522 ; at Barmouth, 324 ; at
Carmarthen, 359 ; at Galway,
506
prevalent at Ardglass, 563 ; in Bel-
fast, 555 ; in Cork and neighbour-
hood, 450 ; at Crickieith, 321 ; in
Lake District, 212 ; at Leaming-
ton, 158 ; at Pwllheli, 320 ; at St.
David's, 368
uncommon at Buncrana, 537 ; at
Clacton-on-Sea, 88 ; at Ennis-

Catarrh—*continued*.

crone, 525; at Llandudno, 312;
at Malvern, 143; at Valentia
Island, 485

Catford Bridge, surface geology and
altitude, 75, 77

Cemmaes Bay, phthisis prevalent at, 317

Central Hill, Norwood, S., surface geo-
logy and altitude, 77

Chalk districts in the County of London
and Greater London, 74

Chalk Farm, N., surface geology and
altitude, 77

Chalybeate springs: Flitwick, 172,—
analysis compared with Tunbridge
Wells water, 172; Kilkee, 499; Lis-
deen, 499; Rathbawn Chalybeate
Well Lisdoonvarna, 585; Rathbawn
Mild Chalybeate or "Magnesia" Well
(Lisdoonvarna), 586; Trefriw, 327

Chalybeate waters (ancient), Islington,
43; Sadlers Wells, 42

Chalybeate and sulphuretted waters,
Dulwich, 43

Chalybeated carbonated waters (ancient),
Hampstead, 42

Champion Hill, Camberwell, S., surface
geology and altitude, 77, 79

Charing Cross, surface geology and alti-
tude, 75

Charlton, S.E., surface geology and
altitude, 74, 79

Cheadle, meteorological tables, 179, 180

Chelsea, crude and corrected death-rates,
53; death-rate from phthisis, 60;
dwellers in inferior tenements exposed
to rheumatism and phthisis, 69;
healthy for dwellers in flats, 69; sur-
face geology and altitude, 75

Chelsea Waterworks Company, and source
of supply, 39

Cheltenham, 145-152; albuminuria
(chronic) uncommon at, 150; anæmia
prevalent at, 150; Anglo-Indians
and Colonials benefit by residence
at, 151; asthma rare at, 150;
bronchitis, amount of prevalence at,
150,—benefited at, 152; calculus
(renal), prevalence of, at, 150; calculus
(vesical), absent almost at, 150,—
benefited at, 150; climate in summer
relaxing, 149; climate less suitable
to the young, 152; death-rate at, 151;
diphtheria, amount of prevalence at,
150; dropsy (renal acute) rare at, 150;
eczema rare at, 150; gravel, amount
of prevalence at, 150; malaria only
among visitors from tropics, 150;
meteorology and climate, 146-149;

Cheltenham—*continued*.

meteorological tables, 147, 148; neu-
ralgia prevalent at times, 150; osteo-
arthritis uncommon at, 150; phthisis
uncommon at, 150; pleurisy rare at,
150; pneumonia, amount of preva-
lence at, 150; protected from east
winds of spring, 149, 151; rainfall
small at, 146; rheumatic fever rare at,
150; rheumatism (muscular) preva-
lent at times at, 150; scarlet fever,
amount of prevalence at, 150; skin
diseases rare at, 150; tubercular dis-
eases uncommon at, 150; typhoid
fever rare at, 150

Chemical composition of Lisdoonvarna
mineral springs, 581-586

Cheshire, death-rate one of highest in
Midland Counties, 132

Cheshunt, surface geology and altitude,
75

Cheshunt Common, N., surface geology
and altitude, 74

Chest diseases benefited at Clifton, 153;
not benefited at Filey, 268

Chigwell, surface geology and altitude,
75, 77

Chigwell Row, N.E., surface geology
and altitude, 74

Childhood, surgical diseases of, benefited
at Felixstowe, 94

Children, benefited by sea-bathing at
Northumberland, Durham and York-
shire coast resorts, 275; benefited at
Rhyl, 302; "dry scurvy" prevalent
at Glengariff in children, 467; Lay-
town, summer resort for children, 577

Childs Hill, N.W., surface geology and
altitude, 77

Chingford, N.E., surface geology and
altitude, 77

Chislehurst, S.E., contra-indicated as a
residence in rheumatism, 72; surface
geology and altitude, 74, 79, 80

Chiswick, surface geology and altitude,
75

Chloride of sodium, a principal ingredient
of the Shearsby spring, 173

Chlorosis benefited by Flitwick chaly-
beate water, 173; by Trefriw ferru-
ginous spring, 328; amount of preva-
lence at Cardiff, 341

Cholera, English, death-rate in London
County, 1899, 59

Chorley Wood, surface geology and alti-
tude, 74, 78

Churchbury, surface geology and alti-
tude, 80

Church Stretton, 171

- Circulation (feeble), benefited at West Kirby, 191
- Circulatory system, diseases of, mortality from, in England and Wales, 64; in Essex, 64; in Kent, 64; in London County, 64; in Middlesex, 64; in Surrey, 64; in Sussex, 64
- Cirencester, sunshine tables, 175
- Clacton-on-Sea, albuminuria (chronic) rare at, 88; asthma rare at, 88; bronchitis uncommon at, 88; calculus and gravel rare at, 88; catarrh uncommon at, 88; climate and meteorology, 87; convalescent homes, 89; debility benefited at, 88; diarrhoea prevalent during summer months only, 89; diphtheria, not common, 89; drainage, 88; dropsy (acute renal), not common, 88; geological formation, 87; hæmoptysis rare at, 88; kidney disease not benefited at, 89; malaria rare at, 89; neuralgia common in spring, 89; phthisis benefited at, 89,—rare at, 88; pleurisy rare at, 88; pneumonia rare at, 88; rheumatism (acute) rare at, 89; rheumatoid arthritis uncommon at, 89; scarlet fever, generally imported, 89; scrofula rare at, 88; skin diseases very uncommon at, 89; tuberculosis rare at, 88; typhoid fever rare at, 89; water supply, 88
- Clapham, healthy as residence, 68; rheumatism benefited at, 71; surface geology and altitude, 75, 77
- Clapton, surface geology and altitude, 75, 80
- Clare (County), 496, 497; *see also* Ballyvaughan, Ennistimon, Kilkee, Kilrush, Lahinch, Miltown Malbay
- Clare Island, 514
- Clay: clay soil when surface undulating not prejudicial to rheumatism, 71; London clay districts in County of London and Greater London, 77, 78; (mottled); *see* Woolwich and Reading Beds
- Claygate, Esher, S.W., surface geology and altitude, 77, 79
- Cleethorpes, 118; unsuitable for invalids, 118
- Clerkenwell, crude and corrected death-rates, 53; death-rate from phthisis, 60
- Clifden, 511
- Clifton, chest complaints benefited at, 153; climate of, 152; kidney affections benefited at, 153
- Clippindale, Dr., on ancient London spas, 42
- Clissold Park, N., surface geology and altitude, 77, 80
- Clogher, 576; climate, 576; drainage (natural), 576; old age prevalent, 576
- Cloghvorra Stone, Kennmare, 470
- Clonakilty, 461
- Clontarf, 404
- Cloud, amount in Durham, in spring, 249,—summer, 251,—autumn, 253,—winter, 254; at Killarney, 494; in Midland Counties, 124,—tables of amount, 125; in Northumberland, in spring, 249,—summer, 251,—autumn, 253,—winter, 254; in Yorkshire, in spring, 249,—summer, 251,—autumn, 253,—winter, 254; in South Wales, 340
- Coal, amounts consumed in London and Sheffield compared, 30
- Coast aspect of North Wales, effect in winter, 288, 296
- Coast-line of Lake District, 200
- Cobham, surface geology and altitude, 75
- Cole, Prof. G., on the geology of Co. Kerry, 469
- Coleraine, 543
- Coln Valley, W. and N.W., surface geology and altitude, 75
- Colney Hatch, surface geology and altitude, 75, 77
- Colonials benefited by residence at Cheltenham, 151
- Colquhoun, Mr. T., notes on Buncrana, 536, 537
- Colwyn Bay, advantages as winter resort, 304–306; asthma rare at, 308; bronchitis and catarrh benefited by, 308; climate as affected by mountains, 304; climate, dry, 307; diarrhoea rare at, 308; diphtheria very rare at, 308; eczema, amount of prevalence at, 308; kidney diseases rare at, 308; meteorological tables, 305, 306, 307; phthisis, scrofula, tuberculosis rare at,—benefited in winter, 307, 308; rheumatism rare at, 308; rheumatoid arthritis rare at, but not benefited by, 308; scrofula rare at, 301; sunshine at, 306; typhoid fever rare at, 308; water supply and drainage, 307
- Coniston, rainfall table, 209
- Convalescents benefited at Barmouth, 324; on East Coast, 86; at Eniscrone, 525; in Isle of Man, 224; at Kilmore Quay, 435; at Llandudno, 313; at Llangollen, 326; at Nevin, 319; at Queenstown (Co. Cork), 458; at Southport, 190; in Vale of Clwyd, 328; in Windermere district, 217

- Coombe, S.W., surface geology and altitude, 77
- Coombe Wood, S.W., surface geology and altitude, 79
- Copperas Well (Lisdoonvarna), analysis, 586
- Cork (City), 446-453; climate relaxing, 449,—*see also* Roche's Point (Cork Harbour), meteorological table; drainage, 452; geology of neighbourhood, 449; gravel benefited at, 449; meteorology, 449; old age prevalent, 452; rainfall, 452; stone benefited at, 449; water supply, 452
- Cork and neighbourhood, anæmia prevalent, 450; asthma prevalent, 451; bronchitis prevalent, 450; calculus absent, 451; catarrh prevalent, 450; debility prevalent, 450; diarrhœa prevalent, 451; diphtheria, amount of prevalence, 451; kidney diseases rare, 451; malarial affections rare, 451; neuralgia prevalent, 451; phthisis prevalent, 450; pleurisy rare, 450; pneumonia rare, 450; rheumatism (acute and chronic), prevalent, 451; scarlet fever, amount of prevalence, 451; scrofula prevalent, 450; skin diseases uncommon, 451; sore throat (relaxed) prevalent, 451; tuberculous diseases prevalent, 450; typhoid fever prevalent, 451; typhus fever still endemic, 451
- Cork (County), 445; pampus prevalent, 451; trachoma prevalent, 451. *See also* Baltimore, Bantry, Blarney, Castletownshend, Clonakilty, Courtmacsherry, Crookhaven, Crosshaven, Glenbrook, Glengarriff, Kinsale, Mal-low, Monkstown, Passage (West), Queenstown, Rosscarbery, Skibbereen, Whitegate and Aghada
- Cotswold Sanatorium, open-air treatment of phthisis at, 155
- Cottenham Park, Wimbledon, S.W., surface geology and altitude, 77
- Country districts, rain in, purer than that in London, 24
- Courtmacsherry, 460
- Courtown Harbour, 431
- Cowley (Uxbridge), surface geology and altitude, 75, 89
- Crabtree Hill, Lambourn, N.E., surface geology and altitude 77, 79
- Cramlington, 259; meteorological tables, 256, 278
- Cray, Mary's, S.E., surface geology and altitude, 74, 79, 80
- Cray, Paul's, S.E., surface geology and altitude, 74
- Crayford, S.E., surface geology and altitude, 74, 75, 79, 80
- Criccieth, asthma, bronchitis, catarrh not infrequent, 321; climate, 321, 322; diphtheria very rare, 322; drainage, 223; hæmoptysis, amount of prevalence, 321; kidney diseases rare, 321; phthisis, amount of prevalence, 321; rheumatism prevalent, 322; scrofula, amount of prevalence, 321; tubercular diseases, amount of prevalence, 321; typhoid fever rare, 322; water supply, 322
- Cricklewood, surface geology and altitude, 75, 77
- Croagh Patrick, 515
- Crofton Park, Lewisham, S.E., surface geology and altitude, 77
- Croly, Dr. T. H., notes on Achill Island and Doogort, 523
- Cromer, 109-111; anæmia benefited at, 110,—rare at, 110; asthma rare at, 110; bronchitis prevalent at, 110; calculus and gravel not uncommon, 110; causes of death, 110; diarrhœa prevalent in summer, 110; diphtheria, amount of prevalence, 110; drainage, 109; malarial affections absent, 110; meteorology and climate, 109; overcrowding in lodgings, 111; phthisis, amount of prevalence at, 110; pleurisy rare at, 110; pneumonia rare at, 110; rheumatism (acute), frequent occurrence of, 110; rheumatoid arthritis uncommon at, 110; scarlet fever, amount of prevalence at, 110; scrofula benefited at, 110,—rare at, 110; sore throat (endemic) rare till 1898, 110; tubercular diseases benefited at, 110,—rare at, 110; typhoid fever rare at, 110; water-supply, 109, 110
- Crookhaven, 463
- Crosshaven, 458; *see also* Drake's Pool
- Crossness, S.E., surface geology and altitude, 75
- Crouch End, metropolitan health resort, 72; surface geology and altitude, 77
- Croydon, S., surface geology and altitude, 74, 75, 79, 80
- Crystal Palace, S., surface geology and altitude, 77
- Cullercoats, 259
- Cumberland, *see also* Alston, Newton Reigny, Scaleby, Seathwaite, Stapleton; death-rate, 214, 215
- Curraclloe, 432
- Curragh of Kildare, 416
- Cushendall, 548
- Cushendun, 548

- DALKEY, 413
- Dalton, Dr., notes on Llandudno, 312
- Darlington, 262, 263; water supply, 263
- Dartford, S.E., surface geology and altitude, 74
- Dartmouth Park, S.E., surface geology and altitude, 77
- Davies, Dr. E., notes on Swansea, 351
- Dawley, surface geology and altitude, 80
- Death-rate:
- at Cardiff, from anæmia, 341; from bronchitis, 343; from diarrhoea, 345; from diphtheria, 346; from phthisis, 342; from pleurisy, 343; from pneumonia, 343; from scarlet fever, 345; from typhoid fever, 344
 - at Cheltenham, 151
 - of Cheshire, one of highest in Midland Counties, 132
 - of Cumberland, 214, 215
 - of Dublin, 397
 - of Furness District of Lancashire, 214, 215
 - at Glasgow, from diarrhoea (infantile), 58
 - of Kingstown, 413
 - of Lake District, 214-216
 - of London County, 51-54; crude and comparative death-rates in the several London districts, 52, 53; death-rate decreasing, 59-61; from bronchitis, 1899, 59; from cancer, 1851-1899, continuous increase, 59; from cholera (English), 1899, 59; from diarrhoea and dysentery, 1899, 58; from diarrhoea (choleraic), 1899, 59; from diarrhoea (infantile), 1899, 58; from diphtheria, 1899, 57; from influenza, 59; from measles, 1899, 57; from pneumonia, 1899, 59; from scarlet fever, 1899, 57; from small-pox, in 1899, 57; from typhoid fever, 1899, 58; from typhus fever in 1899, 57; from whooping-cough, 1899, 57; general and infantile compared with those of other capitals and towns in the United Kingdom, 55; relative increase and decrease at various ages, 55
 - in Midland Counties, generally low except in manufacturing counties, 132; *see* Cheshire, Nottinghamshire, Staffordshire, Warwickshire
 - of Nottinghamshire, 132
 - at South Shields, from diarrhoea, 260
- Death-rate—*continued*.
- of Staffordshire highest in Midland Counties, 132
 - at Swansea, from bronchitis, 352; from cancer, 353; from pleurisy, 352; from pneumonia, 352; from phthisis, 351, 352
 - of Warwickshire, one of highest in Midland Counties, 132
 - of Westmoreland, 214, 215
- Debilitating diseases:
- benefited at Aldeburgh, 94; at Ascot, 164; at Clacton-on-Sea, 88; at Enniscrone, 525; at Filey, 267; by Flitwick chalybeate water, 173; at Malvern, 144; at Southwold, 99; at Tamore, 439
 - not benefited by The Mumbles, 355
- Debility:
- amount of prevalence in Aberystwith, 377; at Cardiff, 341; at Carmarthen, 359; in Fishguard district, 371; at Glengariff, 467; at Leamington, 158; at Swansea, 351
 - prevalent in Cork and neighbourhood, 450; at Galway, 505; in Lake District, 211
 - uncommon at Achill Island and Doogort, 522; at Ardglass, 562; at Tenby, 362; at Valentia Island, 485; at Woburn Sands, 162
- Deganwy, summer resort, 314
- Delgany, 425
- Delicate and neurotic patients benefited at Leamington, 159
- Delirium tremens, amount of prevalence in Lake District, 213
- Denmark Hill, S., surface geology and altitude, 77
- Deptford, S.E., surface geology and altitude, 75
- Derbyshire, *see* Peak District of Derbyshire
- Derry (City), 539-542; rainfall, 542 (County), *see* Bellarena, Castle Rock, Coleraine, Downhill, Port Stewart
- Diarrhoea:
- death-rate in London County, 1899, 59,—in Midland Counties, 134,—at South Shields, 260
 - effect of temperature on death-rate at Cardiff, 345
 - amount of prevalence at Aberystwith, 378; at Cardiff, 344, 345; in Fishguard district, 372; in Glasgow not diminished by pure

Diarrhoea—continued.

- water supply, 58; in Northumberland, Durham and Yorkshire, 272; at Seaham, 261; at Southwold, 99; at Woburn Sands, 162
prevalent at Belfast, 555; at Carmarthen, 369; in Cork and neighbourhood, 451; at Cromer, in summer, 110; at Douglas, Isle of Man, in hot summers, 224; in Dublin, 396
uncommon at Achill Island and Doogort, 522; at Ardglass, 563; at Colwyn Bay, 308; at Felixstowe, 93; at Galway, 506; at Llandudno, 313; at The Mumbles, 355; at St. David's, 368; at Swansea, 352; at Valentia Island, 485
- Digestive system (diseases), mortality from, in England and Wales, 64; in Essex, 64; in Kent, 64; in London County, 64; in Middlesex, 64; in Surrey, 64; in Sussex, 64
- Dingle, 490
- Diphtheria, absent at Achill Island and Doogort, 522; at Criccieth, 322; in Lake District (except in towns), 213; at Tramore, 439
death-rate in London County, 1899, 57
local epidemics in North Wales, 300
outbreaks in 1898 at Felixstowe, 93
amount of prevalence in Belfast increasing, 555; at Cheltenham, 150; in Cork and neighbourhood, 451; at Cromer, 110; at Lowestoft, 104; in Northumberland, Durham and Cornwall, 272; at Seaham, 261; at Woburn Sands, 162
prevalent at Cardiff, 346
rare at Aberystwith, 378; at Ardglass, 564; at Beaumaris, 317; at Carmarthen, 369; at Clacton-on-Sea, 89; at Colwyn Bay, 308; in Fishguard district, 372; at Galway, 506; at Glengarriff, 467; in Isle of Man, 224; at Leamington, 158; at Llandudno, 313; at The Mumbles, 355; at Pwllheli, 320; at Redcar (comparatively), 264; at St. David's, 368; at Southwold, 99; at Swansea, 353; at Valentia Island, 485
- Diuretic: Shap waters a diuretic, 222
- Dollis Hill, N.W., surface geology and altitude, 77, 78
- Dolymount, 404
- Donaghadee, 558; meteorological table, 559; sea-bathing good, 558
- Donegal, 532
- Donegal (County), *see* Buncrana, Bundoran, Cardonagh, Gweedore, Killybegs, Kinlough, Moville, Portsalon, Rathmullan, Rosapenna
- Doogort, 522; *see also* Achill Island and Doogort
- Douglas, Dr., notes on Tenby, 362
- Douglas (Isle of Man), diarrhoea prevalent in hot summers, 224; typhoid fever endemic in, 224
- Dovercourt, 90; asthma not benefited at, 90; neuralgia not benefited at, 90; rheumatism not benefited at, 90; phthisis very uncommon, 90; phthisis in early stages only benefited at, 90; scrofula benefited at, 90; typhoid fever almost unknown, 90; water supply, 90
- Down (County), 556; *see also* Ardglass, Bangor, Carnalea, Donaghadee, Downpatrick, Dundrum, Groomsport, Helen's Bay, Kilkeel, Newcastle, Newry, Newtownards, Portaferry, Peninsula of Ards, Rostrevor, Rostrevor Sanatorium, Warrenpoint
- Downhill, 542
- Downpatrick, 561
- Drainage, at Aberdovey, 326; at Aberystwith, 379; at Achill Island and Doogort, 523; at Amberley, 154; at Ardglass, 564; at Ascot, 163, 164; at Bamburgh, 259; at Barmouth, 324; at Beaumaris, 317; of Belfast, 553; at Bray, 419; at Buncrana, 587; at Cardiff, 346; at Carmarthen, 369; at Clacton-on-Sea, 88; at Colwyn Bay, 307; of Cork, 452; at Criccieth, 322; at Cromer, 109; at Drogheda, 575; at Felixstowe, 92; at Fishguard, 373; at Galway, 506, 507; at Greystones, 424; at Harlech, 323; at Hornsea, 268; in Isle of Man, 224; at Kendal, 220; in Lake District, 211; at Leamington, 156; at Llandudno, 312; at Llandulas, 304; at Llangollen, 326; of London, 44, 46-51; *see also* Sewers and Sewerage (London); at Lowestoft, 102; at Malahide, 407; at Malvern, 142; at The Mumbles, 355; at Nevin, 319; at Penmaenmawr, 315; at Portrush, 545; at Prestatyn, 301; at Redcar, 264; at Rhyl, 302; at St. David's, 369; at Scarborough, 267; at Seaham, 261; at South Shields, 261; at Southwold, 97; at Swansea, 353; at Tenby, 362; at Tramore,

- Drainage—*continued*.
 439; at Valentia Island, 482; at Whitby, 266; in Windermere district, 218; at Woburn Sands, 161; at Great Yarmouth, 108; of Yorkshire, 269; influence on phthisis, 380
- Drake's Pool (Crosshaven), 458
- Drayton Park (Ealing), N.W., surface geology and altitude, 75
- Drayton Park, Highbury, N., surface geology and altitude, 77
- Drogheda, 574, 575; climate, 575; drainage, 575; water supply, 575
- Droitwich brine now conveyed direct to Malvern, 144
- Dromore West, 526
- Dropsy (acute renal):
 amount of prevalence at Achill Island and Doogort, 522
 rare at Ardglass, 563; in Belfast, 555; at Cheltenham, 150; at Clacton-on-Sea, 88; at Felixstowe, 93; at Galway, 506; in Lake District, 212; at Malvern, 143; at Valentia Island, 485; at Woburn Sands, 162
- Dryness, relative, of London, 19
- Dublin (City), 388-403; bronchitis prevalent in, 396; climate, 394-396; death-rate, annual, 397; diarrhoea prevalent in, 396; dwellings of poorer classes insanitary, 390; geology, 389; meteorology, 390-396; pneumonia prevalent, 396; rainfall, 391, 392; suburbs of, 404-416; (*see also* Balbriggan, Booterstown, Clontarf, Dalkey, Dollymount, Dundrum, Howth, Kiliney and Ballybrack, Kingstown, Lucan, Malahide, Merrion, Monkstown, Sandymount, Seapoint, Skerries, Williamstown); surface, 388, 389; temperature, 390, 391; typhoid fever prevalent in, 389; water supply, 396-403
- Dublin (County of), 403
- Dudding Hill, surface geology and altitude, 77
- Dulwich, S., surface geology and altitude, 77, 80
- Dulwich Spring (ancient), sulphuretted and chalybeate waters, 43
- Dulwich, Wood Park, S., surface geology and altitude, 77
- Dun, Sir Patrick, his estates at Bonmahon, 440
- Dundalk, 574; rainfall, 574
- Dundrum (Co. Down), 565
- Dundrum (Co. Dublin), 415
- Dungarvan, 440
- Dunkineely, sulphur spa, 533
- Dunmore East, 439
- Dunquin, vale of, suggested as a health resort for pulmonary diseases, 490, 491
- Durham (County of), drainage (natural), 236; geology, 233; health resorts; *see* Barnard Castle, Bishop Wearmouth, Darlington, Monk Wearmouth, Richmond, Roker, Seaham, Seaton Carew, Shields (South), Sunderland, Ushaw Moor; meteorological tables, *see* Ushaw; minerals, 233; physical features, 232; soils, 235; *see also* Northumberland, Durham and Yorkshire
- Dwellings, insanitary, of poorer classes in Dublin, 390
- Dyffryn, 323
- Dysentery and diarrhoea, death-rate in London, 1899, 58
- Dyspepsia, benefited at Enniscrone, 525; at Filey, 267; by Gowlawn Sulphur Well (Lisdoonvarna), 580, 581
- EALING, N.W., surface geology and altitude, 75, 80
- Earlsfield, Wandsworth, S.W., surface geology and altitude, 75, 77
- Easky, 526
- East Coast, report on, 81-118; anæmia benefited at, 86; climate of, 84-86; convalescents benefited at, 86; meteorology, 84-86; phthisis (early) benefited at, 86; unfavourable (generally) to neuralgia and rheumatism, 86; *see also* Essex, Lincolnshire, Norfolk, Suffolk
- East London Waterworks Company, 39; source of supply, 39
- East winds of spring, protection of Cheltenham against, 149, 151
- Eastcote, N.W., surface geology and altitude, 77, 80
- Eczema:
 aggravated at Northumberland, Durham and Yorkshire coast resorts, 275
 benefited possibly by Shearsby Spring, 173
 amount of prevalence at Carmarthen, 360; at Colwyn Bay, 308; at Galway, 506; in the Lake District, 212; at Leamington, 158; at The Mumbles, 355; in Northumberland, Durham and Yorkshire, 272; at St. David's, 368; at Southwold, 99
 uncommon at Ardglass, 563; at Cheltenham, 150; at Glengarriff, 467; at Llandudno, 313; at Tenby, 362

- Eden Park, surface geology and altitude, 77, 79
- Eden Valley (Lake District), 198; cancer prevalent, 199; heart disease prevalent, 199; phthisis in, 199
- Edgware, N.W., surface geology and altitude, 77
- Edmonton, N., surface geology and altitude, 75, 80
- Edwards, Dr. Grey, notes on Beaumaris, 316
- Egham, surface geology and altitude, 75, 77
- Elliott, Dr. W. S., notes on Malahide, 407
- Elmer's End (Beckenham), S.E., surface geology and altitude, 75, 77, 79
- Elstree, N.W., surface geology and altitude, 77
- Elterwater, rainfall table, 207
- Eltham, S.E., surface geology and altitude, 79, 80
- Elthorne (Hanwell), N.W., surface geology and altitude, 75, 77
- Enfield, N., surface geology and altitude, 75, 80
- Enfield Chase, N., surface geology and altitude, 74
- Enfield Highway, N., surface geology and altitude, 75, 80
- England and Wales, crude and corrected death-rates, 53; mortality from all causes, 63; from cancer, 63; from diseases of circulatory system, 64,—of digestive system, 64,—of nervous system, 65,—of respiratory system, 64,—of urinary system, 64; mortality from phthisis, 61
- Enniscrone (or Inishcrone), 524; asthma not benefited at, 525; bronchitis and catarrh rare at, 525; climate, 525; convalescents from pneumonia and typhoid fever benefit at, 525; debility and dyspepsia benefited at, 525; epidemic diseases rare at, 525; phthisis rare at, 525; pleurisy rare at, 525; pneumonia rare at, 525; rheumatism (chronic) benefited at, 525; skin diseases rare at, 525
- Enniskerry, 420; asthma benefited at, 420; bronchial catarrh benefited at, 420; meteorology, 421-423; phthisis (early) benefited at, 420; pneumonia (unresolved) benefited at, 420
- Ennistimon, 501
- Epping, N.E., surface geology and altitude, 74, 77
- Epsom, S.W., surface geology and altitude, 74, 80
- Erith, S.E., surface geology and altitude, 74, 79
- Esher, S.W., surface geology and altitude 77, 79
- Esler, Dr. R., note on Garron Tower, 549
- Essex Convalescent Home, Clacton-on-Sea, 89
- Essex (County of), mortality from all causes, 63; from cancer, 63; from diseases of circulatory system, 64,—of digestive system, 64,—of nervous system, 65,—of respiratory system, 64,—of urinary system, 64; mortality from phthisis, 64; surface and geological formation, 82. *See also* Clacton-on-Sea, Dovercourt, Frinton-on-Sea, Southend, Walton-on-the-Naze
- Ewart, Dr. W., report on the Counties of London and Middlesex, 1-80; on the decrease of ague and aguish affections in London, 61
- Exwell, S.W., surface geology and altitude, 74, 79, 80
- Eynesford, S.E., surface geology and altitude, 74, 75
- FARNINGHAM, S.E., surface geology and altitude, 74, 75
- Felixstowe, anæmia rare at, 92; bronchitis benefited at, 93; calculus (renal) rare at, 93; causes of death, 93; debility rare at, 92; diarrhœa rare at, 93; diphtheria outbreaks rare at, 93; drainage, 92; dropsy (renal acute) rare at, 93; malaria absent, 93; meteorology, 92; neuralgia, amount of prevalence, 93; old age frequent, 93; phthisis rare at, 93; scarlet fever, amount of prevalence, 93; scrofula and tuberculous diseases uncommon at, 93; surface and geological formation, 91; surgical diseases of childhood benefited at, 94; tuberculous diseases of glands and joints benefited at, 94; typhoid fever rare at, 93; water supply, 92
- Feltham, W., surface geology and altitude, 75
- Ferguson, Dr. G. B., reports on prevalence of disease at Cheltenham, 150
- Fermanagh (County), *see* Rossclare Sanatorium
- Ferryside, 357
- Filey, 267, 268; chest affections not benefited at, 268; debility benefited at, 267; dyspepsia benefited at, 267; nervous affections benefited at, 267; rheumatism not benefited at, 268
- Finchley, N., meteorological records, 12; surface geology and altitude, 74, 79, 80

- Finsbury Park, N., surface geology and altitude, 78
- Fishguard Bay, 369
- Fishguard district, anæmia and debility, amount of prevalence in, 371; asthma uncommon in, 371; diarrhoea uncommon in, 372; diphtheria rare in, 372; drainage and water supply in, 373; endemic sore throat, amount of prevalence in, 372; kidney disease in, 371, 372; malaria disappearing in, 372; phthisis and hæmoptysis, amount of prevalence in, 371; pneumonia, bronchitis, pleurisy, amount of prevalence in, 371; rheumatism and rheumatoid arthritis very prevalent in, 372; scarlet fever rare in, 372; scrofula uncommon in, 371; skin diseases, amount of prevalence in, 372; tubercular diseases uncommon in, 371; typhoid fever rare in, 372
- Fleetwood, not desirable as health resort, 189
- Fletcher, Mr. A. E., on annual consumption of coal in London and Sheffield, 29, 30
- Flinn, Dr. Edgar, notes on Queenstown (Co. Cork), 458; on climate of Glengarriff, 466; on Parknasilla as a health resort, 471, 472
- Flitwick Chalybeate water, 172; anæmia, chlorosis and debility benefited by, 173; analysis compared with Tunbridge Wells water, 172
- Fog, in Durham, 247; of London, 26, 27,—decline of, 31,—“ground fog,” 33, 34,—“high fog,” vertical production of, 34,—influence of temperature and radiation on, 35,—mode of production of, 33–35,—relative local prevalence of, 36,—in Northumberland, 247; in Yorkshire, 247; mortality from, 27; natural history of, 31. *See also* Mist
- Food, artificial and tinned, possible cause of increased mortality from infantile diarrhoea, 59
- Foohagh, or Fougha Spa (slightly chalybeate and containing sulphuretted hydrogen), 499
- Foots Cray, S.E., surface geology and altitude, 75
- Forest Gate, E., surface geology and altitude, 75
- Forest Hill, S., surface geology and altitude, 77
- Forty Hill, surface geology and altitude, 75
- Fraser, Dr., notes on Carnarvon, 294
- Friern Barnet, surface geology and altitude, 77, 79
- Frinton-on-Sea, 89
- Fulham, as a residence, 69; crude and corrected death-rates of, 53; death-rate from phthisis, 60; surface geology and altitude, 75
- Fulwell (Twickenham), W., surface geology and altitude, 75
- Furness district of Lancashire, death-rate, 214, 215; rainfall, 208; rainfall tables, *see* Barrow, Coniston, Grange
- GALWAY, 504; albuminuria not uncommon at, 506; anæmia and debility prevalent at, 505; asthma rare at, 506; bronchitis and catarrh, amount of prevalence at, 506; calculus and gravel rare at, 506; causes of death at, 506; diarrhoea rare at, 506; diphtheria rare at, 506; drainage, 506, 507; dropsy (acute renal) rare at, 506; eczema, amount of prevalence at, 506; malaria absent at, 506; neuralgia, amount of prevalence at, 506; old age prevalent at, 506; phthisis prevalent at, 505, 506; pleurisy rare at, 506; pneumonia rare at, 506; Queen's College, 507; rheumatism and rheumatoid arthritis, amount of prevalence at, 506; scarlet fever rare at, 506; scrofula, amount of prevalence at, 505; skin diseases, amount of prevalence at, 506; sore throat (endemic), amount of prevalence at, 506; tuberculous diseases, amount of prevalence at, 506; typhoid fever, amount of prevalence at, 506; water supply, 507. *See also* Salt-hill, 505
- Galway (County), 503, 504. *See also* Barna, Clifden, Leenane, Letterfrack, Oughterard, Recess, Roundstone, Spiddale
- Gangrene (senile), rare in Lake District, 213
- Gardner, Mr. F., notes on Leamington, 155
- Garron Tower, 549
- Gastro-intestinal disturbances, prevalence at Pwllheli, 320
- Geology of Belfast district, 554; of Buncrana, 537; of Clacton-on-Sea, 87; of Cork and its neighbourhood, 449; of Dublin (City), 389; of Durham, 233; of Essex, 82; of Felixstowe, 91; of Ireland, 382, 383; of

Geology—continued.

- Kerry, 468, 469; of Lake District, 202; of Lincolnshire, 83; of Greater London, 6; of Greater London, index to surface geologies and altitudes, 73-80; of London Basin, 6; of London County, index to surface geologies and altitudes, 73-80; of Malvern, 139; of Midland Counties, 120; of Norfolk, 83; of Northumberland, 233; of Recess (Connemara), 509; of Southwold, 95; of Suffolk, 82; of Valentia Island, 475; of North Wales, 288; of South Wales, 331-333; of Woburn Sands, 160; of Yorkshire, 233; *see also* Soils
- Gipsy Hill, Norwood, S., surface geology and altitude, 77
- Glands (tuberculous diseases of), amount of prevalence in Northumberland, Durham and Yorkshire, 271; benefited especially at Felixstowe, 94
- Glasgow, death-rate from diarrhoea (infantile), 58
- Glenarm, 550; sea-bathing good, 550
- Glenbeigh, 487
- Glenbrook, 455
- Glenгарiff, 464-467: anemia and debility rather prevalent at, 467; climate at its best in spring, 465; diphtheria rare at, 467; "dry scurvy" prevalent in children at, 467; eczema rare at, 467; kidney diseases rare at, 467; measles rare at, 466; old age prevalent at, 466; phthisis benefited at, in some cases, 466; respiratory diseases rare at, 467; rheumatism prevalent at, 467; scarlet fever rare at, 466; skin diseases, amount and causes of prevalence of, 467; sore throat (endemic) absent at, 467; sore throat (ulcerated), amount of prevalence of, 467; tonsillitis prevalent at, 467
- Goitres (enormous), rare in Lake District, 213; smaller ones common, 213
- Golder's Green, N., surface geology and altitude, 77
- Gonorrhœa, rare in Lake District, 213
- Goodwick, 370; tubercular cases likely to benefit at, 371; *see also* Fishguard (district)
- Gorleston (Great Yarmouth), 105
- Gospel Oak, N., surface geology and altitude, 77
- Gout:
 - benefited by Gowlawn Sulphur Well (Lisdoonvarna), 580, 581,—at Malvern, 144,—(possibly) by Shearby Spring, 173

Gout—continued.

- prevalent at Leamington, 158
rare in Lynn and Lynn district, 118
- Gower, *see* Peninsula of Gower
- Gowers, Sir William, F.R.S., notes on the therapeutical effects of the climate of Southwold, 94
- Gowlawn Sulphur Well (Lisdoonvarna), analysis of, 582; chronic arthritis benefited by, 581; dyspepsia (atonic) benefited by, 580; effects of alcoholism benefited by, 581; gastric catarrh benefited by, 580; gout benefited by, 580, 581; sulphuretted hydrogen in, variation in strength of, 583
- Grand Junction Waterworks Company, 39; source of supply, 39
- Grange, 189, 201; Bright's disease benefited at, 189; bronchitis benefited at, 189; climate of, 217; nerve excitement benefited at, 189; rainfall table of, 209
- Gravel: London gravel area healthy for residence, 71; of higher grounds in County of London and Greater London, 78; valley gravel and sand districts in County of London and Greater London, 75-77; *see also* Blackheath Beds, Woolwich and Reading Beds
- Gravel:
 - absent at Achill Island and Doogort, 522; at Buncrana, 537; at Valentia Island, 485
 - benefited at (presumably) Achill Island and Doogort, 522; at Cork and in neighbourhood, 449
 - amount of prevalence at Cheltenham, 150; at Cromer, 110
 - prevalent at Leamington, 158
 - rare at Ardglass, 563; in Belfast, 555; at Clacton-on-Sea, 88; at Galway, 506; in Lake District, 212; at Malvern, 143; in Northumberland, Durham and Yorkshire, 270; at Woburn Sands, 162.
- See also* Calculus
- Great Yarmouth, *see* Yarmouth (Great)
- Green Lanes, N., surface geology and altitude, 77, 80
- Green Park, surface geology and altitude, 75, 77
- Greenford, W., surface geology and altitude, 75, 77
- Greenhill, Harrow, N.W., surface geology and altitude, 77
- Greenore, 572-574; rainfall, 573
- Greensand (Lower), districts in Greater London, 79
- Greenwich. S.E., crude and corrected

- Greenwich, S.E.—*continued*.
 death-rates of, 53; death-rate from phthisis, 60; surface geology and altitude, 75, 79, 80
- Greenwich (North), S.E., surface geology and altitude, 75
- Greystones, 424; drainage and water supply, 424; rainfall, 425, 426; sea-bathing excellent, 424
- Groomsport, 558
- Grove Park (Chiswick), 20; surface geology and altitude, 75
- Gulf Stream: *see* Ocean Currents
- Gunnersbury, W., surface geology and altitude, 75
- Gweedore, 534; climate, 534
- HACKBRIDGE, S.W., surface geology and altitude, 75
- Hackney, N.E., 71; crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 75
- Hackney Wick, surface geology and altitude, 75, 77
- Hadley Wood, N., surface geology and altitude, 77
- Hæmoptysis:
 amount of prevalence at Beaumaris, 316; at Criccieth, 321; in Belfast, 555; at Carmarthen, 359; at Cromer, 110; in Isle of Man, 224
 rare at Barmouth, 324; at Bun-crana, 537; at Clacton-on-Sea, 88; at Llandudno, 313; in Northumberland, Durham and Yorkshire, 271; at Rhyl, 302; at Swansea, 351; at Tenby, 362
- Hainault Forest, N.E., surface geology and altitude, 75, 77
- Halifax, meteorological tables, 256, 283
- Ham, S.W., surface geology and altitude, 75
- Ham (East), E., surface geology and altitude, 75
- Ham (West), E., surface geology and altitude, 75
- Hammersmith, W., as a residence, 69; crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 75, 80
- Hampstead, N.W., crude and corrected death-rates, 53; death-rate from phthisis, 60; metropolitan health resort, 72; surface geology and altitude, 77
- Hampstead Spa (ancient), carbonated chalybeate, 43
- Hampton, W., surface geology and altitude, 75
- Hampton Court, W., surface geology and altitude, 75
- Hampton Wick, W., surface geology and altitude, 75
- Hangers Hill Park, Ealing, N.W., surface geology and altitude, 77
- Hanwell, N.W., surface geology and altitude, 75
- Harefield, N.W., surface geology and altitude, 74, 77, 79, 80
- Harlech, 323
- Harlesden, N.W., surface geology and altitude, 77
- Harlington, N.W., surface geology and altitude, 75
- Harringay Park, N., surface geology and altitude, 77
- Harrow, N.W., surface geology and altitude, 77, 79
- Harrow Weald, N.W., surface geology and altitude, 77
- Hatch-End, Pinner, N.W., surface geology and altitude, 77
- Havell, Dr. C. G., notes on Felixstowe, 91
- Haverstock Hill, N.W., surface geology and altitude, 77
- Hay asthma, benefited by Valentia Island, 486
- Hayes (Kent), surface geology and altitude, 75, 79
- Hayes (Middlesex), surface geology and altitude, 75, 80
- Health (general) of Midland Counties, 132:
 (public), evil effect of smoke on, 27
- Heart disease:
 benefited at Southport, 190,—at Woburn Sands, 162
 certain varieties of, not benefited by Blackpool, 189
 prevalent in Eden Valley (Lake District), 199
- Helen's Bay, 556; sea-bathing good, 556
- Herbert, Dr. A. C., notes on Southwold, 94
- Herne Hill, S., as a residence, 68; surface geology and altitude, 77
- Hersham, S.W., surface geology and altitude, 75
- Heston, W., surface geology and altitude, 75, 80
- Hichens, Dr. P. S., notes on Rossclare Sanatorium and system of treatment adopted there, 530, 531
- Hicks, Dr. Philip, notes on Leamington, 155

- High Beech, surface geology and altitude, 79
- Higham Park, N.E., surface geology and altitude, 75, 77
- Highbury, N., surface geology and altitude, 75, 77, 80
- Highgate metropolitan health resort, 72; surface geology and altitude, 77, 79
- Highwood, Essex, N.E., surface geology and altitude, 74, 77, 79, 80
- Highwood Hill, N.W., surface geology and altitude, 75, 77
- Hillingdon, W., surface geology and altitude, 75
- Hillington (Norfolk), meteorological observations, 85
- Hills and mountains over 1,000 feet above sea-level in Lake District, 199
- Hither Green, S.E., surface geology and altitude, 76, 77, 80
- Hodsock, meteorological tables, 182
- Holborn, crude and corrected death-rates, 53; death-rate from phthisis, 60
- Holland Park, W., surface geology and altitude, 77, 80
- Holloway, N., surface geology and altitude, 77
- Holy Island, 317
- Homerton, 71
- Honor Oak, Forest Hill, S.E., surface geology and altitude, 77
- Hook, Long Ditton, S.W., surface geology and altitude 77
- Hornsea, 268; drainage, 268; water supply, 268
- Hornsey, N., surface geology and altitude, 77
- Horsenden Hill, Harrow, N.W., surface geology and altitude, 77
- Horton-Smith, Dr. P., the climate of the Midland Counties, 119-186
- Hospitals for isolation at Great Yarmouth, 108
- Hounslow, W., surface geology and altitude, 76
- Howth, 404-406
- Hoylelake, 191; bronchitis (chronic), not benefited at, in winter and early spring, 191
- Hughes, Dr. Evan, notes on Nevin, 319
- Hughes, Dr., notes on Barmouth, 324
- Hull, meteorological tables, 256, 284
- Hull, Prof. E. H., on Barna, 507; on geology of Recess, Connemara, 509
- Humidity, at Colwyn Bay, 307; of Durham, 244,—in spring, 249,—summer, 251,—autumn, 253,—winter, 255; of Lake District, 208; of Midland
- Humidity—*continued*.
- Counties, with table, 127; of Northumberland, 244,—in spring, 249,—summer, 251,—autumn, 253,—winter, 255; of North Wales, 290; of South Wales; effect of, on phthisis, 380; of Yorkshire, 244,—in spring, 249,—summer, 251,—autumn, 253,—winter, 255
- Hunstanton, 112
- Hurlingham Park, surface geology and altitude, 76
- Hyde Park, surface geology and altitude, 76, 77
- Hydrogen sulphide springs: Dunkineely, 533; Kinlough, 532; Lisdoonvarna, 578-585; Lucan, 416
- Hydrography of Greater London, 7
- Hydropathic Establishment, St. Anne's Hill, Blarney, 454
- ICKENHAM, surface geology and altitude, 77
- Ilford, Great, E., surface geology and altitude, 76, 80
- Ilford, Little, surface geology and altitude, 76
- Illegitimacy, prevalent in Lake District, 213
- Inch, 489
- Infection of London watersupply possible, 41
- Infectious diseases at Yarmouth (Great), 108
- Influenza, amount of prevalence at Tramore, 439; death-rate in London County (1899), 59
- Inhabitants of Lake District, 201
- Inishcraone, *see* Enniscraone
- Insanity, prevalent in Isle of Man, 224,—in Lake District, 213
- Insomnia, due to overwork, benefited at Kilmore Quay, 135
- Invalids, Blackpool in summer undesirable for, 189; Cleethorpes unsuitable for, 118; Mablethorpe unsuitable for, 118; Skegness unsuitable for, 118; Southend hardly suitable for, 90; Sutton-on-Sea unsuitable for, 118
- Ireland, 381-577; climate, chief features, 384-387; geology, 382, 383; health resorts, classification of, 387, 388,—bracing, 388,—relaxing, 388; minerals, 383; mineral springs of, 383, 578-586. *See also* Dunkineely, Kilkee, Kinlough, Leixlip, Lisdoonvarna, Lucan, Mallow; National Hospital for Consumption for Ireland, 428; physical characters of, 381

- Iron an ingredient of Flitwick water, 172; of Kilkee Spa, 499; of Lisdeen Spa, 499; of Lisdoonvarna Spa, 585-86; of Trefriw springs, 327; of Tunbridge Wells water, 172; slight ingredient of Ffooagh Spa, 499. *See also* Chalybeate springs
- Isle of Dogs, E., surface geology and altitude, 75
- Isle of Man, 222-224; anæmia benefited in, 224; convalescents benefited by, 224; diphtheria rare in, 224; drainage, 224; hæmoptysis prevalent in, 224; insanity prevalent in, 224; kidney disease benefited in, 224; phthisis prevalent in, 224; rainfall, 223; rheumatoid arthritis not benefited in, 224; sunshine, 223; tuberculous affections of bones and joints benefited in, 224; water supply, 224. *See also* Douglas (Isle of Man)
- Isleworth, W., meteorological records, 12; surface geology and altitude, 76
- Islington, N., as a residence, 70; crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 76, 77
- Islington Spa (ancient), chalybeate, 42, 43
- JACK'S HILL, Epping, N.E., surface geology and altitude, 78, 79
- Joints (tuberculous diseases of):
 amount of prevalence in Northumberland, Durham and Yorkshire, 271
 benefited in Isle of Man, 224; at Felixstowe, 94
- KELLY, Dr. J. B., notes on Drogheda, 575
- Kempton Park, S.W., surface geology and altitude, 76
- Kendal, 219; drainage and water supply, 220; mortality tables, 221; meteorological tables, 221
- Kenilworth, meteorological tables, 157, 158
- Kenmare, 469, 470
- Kennington, S., surface geology and altitude, 76
- Kensal Green, N.W., surface geology and altitude, 78
- Kensal Rise, N.W., surface geology and altitude, 78
- Kensington, W., as a residence, 70; crude and corrected death-rates, 53; death-rate from phthisis, 60; some districts favourable to rheumatism, Kensington, W.—*continued*.
 71; surface geology and altitude, 76, 80; various climates of, 70
- Kensington (South), bronchial affections benefited at, 72
- Kent, mortality from all causes, 63; from cancer, 63; from diseases of circulatory system, 64,—of digestive system, 64,—of nervous system, 65,—of respiratory system, 64,—of urinary system, 64; from phthisis, 64
- Kent Waterworks Company, 39; source of supply, 39
- Kentish Town, N., as a residence, 70; surface geology and altitude, 78
- Kenton Harrow, N.W., surface geology and altitude, 78
- Kerry (County), 467-469; geology, 468, 469; rainfall in extreme south-west district, 494. *See also* Anascaul, Ballybunion, Cahirciveen, Caragh Lake, Dingle, Glenbeigh, Inch, Kenmare, Killarney, Parknasilla, Valentia Island, Waterville
- Kershaw, Dr., notes on Aberdovey, 325
- Keston, S.E., surface geology and altitude, 74, 79, 80
- Kew, sunshine tables, 176; surface geology and altitude, 76
- Kidbrooke, S.E., surface geology and altitude, 78, 79
- Kidney (diseases):
 benefited at Clifton, 153; in Isle of Man, 224; at St. Ann's and Lytham, 190; at Tenby, 363; at West Kirby, 191; at Weybridge, 72; at Woking, 72
 not benefited at Blackpool, 189; at Clacton-on-Sea, 89; at Northumberland, Durham and Yorkshire coast resorts, 275
 amount of prevalence at Aberystwith, 378; at Beaumaris, 316; at Buncrana, 537; at Cardiff, 343; at Carmarthen, 360; at Colwyn Bay, 308; in Cork and neighbourhood, 451; at Criccieth, 321; in Fishguard district, 371, 372; at Glengariff, 467; in Lake District, 212; at Llandudno, 312; at Malahide, 407; at The Mumbles, 355; in Northumberland, Durham and Yorkshire, 275; at Pwllheli, 320; at St. David's, 368; at Southwold, 99; at Swansea, 352; at Tenby, 362; at Tamore, 439
- Kilburn, N.W., as a residence, 70; surface geology and altitude, 78
- Kilburn Spa (ancient), 43

- Kildare (County), *see* Curragh of Kildare
 Kildare (Town), 417
 Kilkee, 498, 499
 Kilkee Spa (iron, salts of sodium and magnesium, and carbonic acid), 499
 Kilkeel, 568
 Killala, 524
 Killarney, 492-494; climate of, 492; cloud, amount of, 494; rainfall of, 493, 494; temperature of, 493
 Killiney and Ballybrack, 414; rainfall table (Killiney), 415
 Killough, 562
 Killybegs, 533; climate of, 533; sea-bathing good, 533
 Kilmore Quay, 435; convalescents benefited at, 435; epidemic diseases rare at, 435; phthisis benefited at, 435; strumous cases benefited at, 435; sufferers from overwork and insomnia benefited at, 435; water supply of, 435
 Kilrush, 498
 King's County, *see* Parsonstown
 King's Cross (London) as a residential district, 70
 Kingsbury, surface geology and altitude, 76, 78
 Kingsland, N.E., surface geology and altitude, 76
 Kingston-on-Thames, surface geology and altitude, 76
 Kingstown, 409-413; climate and meteorology, 410; death-rate, 413; water supply, 413
 Kinkead, Dr. R. J., notes on Galway and Salthill, 505
 Kinlough, hydrogen sulphide spring, 532
 Kinsale, 459
 Kirkby Stephen, 219
 Kirkley (Lowestoft), 100
 Knight's Hill, Dulwich, S., surface geology and altitude, 80
 Knightsbridge, surface geology and altitude, 76, 78
 Knotts Green (Walthamstow), surface geology and altitude, 76, 78
 Knowling, Dr., notes on Tenby, 362
 Knox, Dr. Alexander, on climate of Dunquin, 490, 491; on Kilkee, 498; on mineral springs in vicinity of Kilkee, 499
 LADYWELL, S.E., surface geology and altitude, 80
 Lahinch, 500
 Lake District, 195-229; albuminuria (chronic), rare, 212; alcoholism prevalent, 213; anæmia prevalent, 211; Lake District—*continued*.
 aneurysm very rare, 213; arteries (rigid calcareous) rare, 213; asthma not benefited in, 217,—prevalent, 212; bronchitis prevalent, 212; calculi (biliary) common, 213; calculi (urinary) rare, 212; catarrh prevalent, 212; climate, general description of, 204; coast-line, 200. *See also* Arnside, Grange, St. Bees, Seascale, Silloth; death-rate, 214-216; debility prevalent, 211; definition of district, 196; delirium tremens, amount of prevalence, 213; dental caries prevalent, 213; diphtheria absent (except in towns), 213; drainage, 211; dropsy (acute renal) rare, 212; eczema, amount of prevalence, 212; gangrene (senile) rare, 213; geology, 202; goitres (enormous) rare, 213; goitres (slight) common, 213; gonorrhœa rare, 213; gravel rare, 212; high lands on south-east side, 219; *see* Kirkby Stephen; humidity, 208; illegitimacy prevalent, 213; inhabitants, 201; insanity prevalent, 213; kidney (granular), amount of prevalence, 212; lakes and rivers, 197; malaria absent (almost), 213; meteorology, 203; minerals obtained in, 200; mortality in, 213; mountains and hills over 1,000 feet above sea-level, 199; neuralgia prevalent (generally) in, 212; old age in, 213; osteo-arthritis not benefited in, 217; phthisis, amount of prevalence in, 211, 212; pleurisy rare in, 212; pneumonia, amount of prevalence in, 212; puerperal fever prevalent in, 216; rainfall, 205; rheumatism (acute) rare (generally), 212; rheumatoid arthritis prevalent, 212; scarlet fever, amount of prevalence of, 213; scrofula, amount of prevalence of, 211; sore throat (endemic) fairly prevalent, 213; syphilis absent in country districts, 213; tuberculous diseases, amount of prevalence in, 211; typhoid fever absent except in towns, 213; vegetation, 208; water supply and sanitation, 211. *See also* Cumberland; Eden Valley (Lake District); Furness district of Lancashire; Westmorland; Windermere
 Lakes and rivers of Lake District, 197
 Lambeth, S., crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 75, 76
 Lambeth Waterworks Company, 39; source of supply of, 39

- Lambeth Wells (ancient), saline purgative, 43
- Lambourne, N.E., surface geology and altitude, 74, 78, 79
- Lancashire, climate of, 187-191; *see also* Blackpool, Fleetwood, Grange, Lytham, Morecambe, St. Anne's, Southport; meteorology, 187, 188; *see also* Furness district of Lancashire
- Langdon Hill, surface geology and altitude, 78, 79
- Langland Bay, 356
- Larne, 551
- Lavender Hill, S.W., surface geology and altitude, 76
- Laytown, 577; climate, 577; drainage, 577; sea-bathing, 577; summer resort for children, 577; water supply, 577
- Lazarus-Barlow, Dr. W. S., the climate of Northumberland, Durham and Yorkshire, 230-285
- Lea: pollution of river Lea by sewage, 41, 48, 50
- Lea Valley, N. and N.E., surface geology and altitude, 75
- Leamington, 155-159; aged subjects benefited at, 159; anæmia, amount of prevalence at, 158; asthma rare at, 158; bronchitis prevalent at, 158; calculus (vesical) almost absent at, 158; catarrhs prevalent at, 158; climate of, 158; debility, amount of prevalence at, 158; delicate and neurotic patients benefited at, 159; diphtheria very rare at, 158; drainage of, 156; malaria absent at, 158; meteorology of, 156-158; meteorological tables, 157; neuralgia prevalent at, 158; phthisis rare at, 158; pleurisy, amount of prevalence at, 158; pneumonia (lobar), rare at, 158; rheumatism (acute) rare at, 158; (muscular) prevalent at, 158; scarlet fever, amount of prevalence at, 158; skin affections rare at, 158; tubercular diseases rare at, 158; typhoid fever very rare at, 158; water supply of, 156
- Lee, crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 79, 80
- Lee, Dr. Philip G., notes on Cork, 447
- Leech, Dr. D. J., the climate of North Wales, 286-328
- Leenane, 513
- Leicester, sunshine tables, 175
- Leixlip Spa, 416
- Letchmore Heath, N.W., surface geology and altitude, 74
- Letterfrack, 512, 513
- Letters, Dr. Patrick, notes on Valentia Island, 474-487
- Leucocythæmia, prevalence at Cardiff, 341
- Lewisham, S.E., crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 74, 76, 78, 80
- Leybourne, surface geology and altitude, 76, 79
- Leyton, N.E., surface geology and altitude, 76
- Leyton (Low), surface geology and altitude, 76
- Leytonstone, N.E., surface geology and altitude, 76, 78
- Life, annual gain or loss shown by London Life Tables, 55
- Limehouse, crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 76
- Limerick (City), 495, 496
- Lincolnshire; *see also* Cleethorpes, Mablethorpe, Skegness, Sutton-on-Sea; general physical characters and geology of, 83, 84
- Lisdeen Spa, 499
- Lisdoonvarna, health-giving summer and autumn residence, 581
- Lisdoonvarna mineral springs, 496, 501, 578-586; chemical composition of, 581-586; therapeutical action of, 581; *see also* Gowlawn Sulphur Well, Rathbawn Chalybeate Well, Rathbawn "Magnesia" Well, Twin Sulphur Well
- Lismore, 444
- Littlejohn, Dr. H., on prevention of smoke, 30
- Llanbedr, 323
- Llanbedrog, 321
- Llandudno, asthma benefited at, 313; bronchitis, catarrh, pneumonia rare at, 312; climate of, as affected by mountains, 309, 310; convalescents benefited at, 313; diarrhoea rare at, 313; diphtheria rare at, 313; drainage and water supply of, 312; eczema rare at, 313; hæmoptysis rare at, 313; kidney diseases, amount of prevalence at, 312; meteorological tables of, 292, 311; phthisis benefited at, 313,—rare at, 312; rainfall of, 289, 311, 312; rheumatism and arthritis rare at, 312; scarlet fever rare at, 313; sea-bathing at, 313; subsoil of, 312; sunshine in winter at, 314
- Llandulas, drainage, 303; water supply, 304

- Llanelli district, 359
- Llanfairfechan, climate as affected by aspect and winds, 315; a winter and summer resort, 315
- Llangollen, drainage and water supply, 326; convalescence promoted on the hills around, 326
- Lleyn Peninsula, 289, 318, 319; *see also* Abersoch, Llanbedrog, Nevin, Pwllheli
- Lloyd, Dr., notes on Barmouth, 295, 324
- Lloyd, Dr. Eyton, notes on Rhyl, 297, 298, 302
- Loam, *see* Brickearth.
- Lock, Mr. J. G., notes on Tenby, 362
- London:
- air of, 20; carbonic acid in, 24; composition and impurities of, 20; local difference in purity of, 22
 - amount of coal consumed in London compared with that used in Sheffield, 30
 - baths and wash-houses in, 43, 45
 - drainage of, 44, 46-51; *see also below*, Sewers and Sewerage
 - dryness (relative) of, 19
 - fogs in, 26, 27; decline of, 31; formation of, influenced by temperature and radiation, 35; "ground fog," 33, 34; "high fog," vertical production of, 34; mode of production of, 33-35; relative local prevalence of, 36
 - gravel area, healthy as residence, 71
 - mist in, diminished by building, 33
 - rain, impurities in, 23
 - sewers and sewerage of, 44, 46-51; amount dealt with yearly and cost of, 50; defects in system and remedies proposed, 47; extension proposed, 46, 47; question of sewage disposal in suburban areas, 49
 - smoke of, 26, 28
 - Spas, ancient, of, 42, 43
 - sunshine in, 17
 - temperature of, hotter in summer and less cold in winter than in Midland Counties, 129, 131
 - Water Companies, 38, 39; source of supply, 39
 - water supply of, 37-40; danger of water famine, 42; dangers connected with, 41; defects in, 41; depletion of rivers due to, 41; possible impurity of, 41; possible infection of, 41
- London (Central) as a residence, 66;
- London (Central)—*continued*.
- advantages, 66, 67; climate, 66, 67; *see also* under local names
- London (City of), crude and corrected death-rates, 53; death-rate from phthisis, 60
- London (County of), 1-80; altitude: index to surface geologies and altitudes, 73-80; artificial characters of, 3
- death-rate, comparative, in the several sanitary districts, 52, 53; crude and corrected, 53; from bronchitis, 1899, 59; from cancer, 1851-1899, continuous increase of, 59; from cholera (English), 1899, 59; from diarrhoea and dysentery, 1899, 58; from diarrhoea (choleraic), 1899, 59; from diarrhoea, infantile, 1899, 58; from diphtheria, 1899, 57; from influenza, 1899, 59; from measles, 1899, 57; from phthisis, 60,—decreasing mortality from, 59-61; from pneumonia, 1899, 59; from scarlet fever, 1899, 57; from small-pox, 1899, 57; from typhoid fever, 1899, 58; from typhus fever in 1899, 57; from whooping-cough, 1899, 57; general and infantile, compared with those of foreign Capitals, and other towns in the United Kingdom, 55; relative increase and decrease of, at various ages, 55
- geology: index of surface geologies and altitudes, 73-80
- health resorts within, 72; Blackheath, 72; Crouch End, 72; Hampstead, 72; Highgate, 72; Norwood (Upper), 72; Putney, 72; Sydenham, 72
- malaria, 61; question whether still endemic, 61-63
- mortality, 51-54; from all causes, 63: from cancer, 63; from diseases of circulatory system, 64,—of digestive system, 64,—of nervous system, 65,—of respiratory system, 64,—of urinary system, 64; of districts severally, 52, 53; from phthisis, 64; and death-rate, 51-54
- (Greater), altitudes, 7; index to surface geologies and altitudes, 73-80
- climatology, artificial modifying influences, 9; general, 9-20; natural climate of, 9

London (Greater)—*continued*.

definition of area, 5
geology, general, 6; index of surface geologies and altitudes, 73-80
hydrography, 7
meteorological data, 14, 15; meteorology of, general, 9-20
surface configuration, 7
(suburban), *see* under local names

London Basin, geology of, 6

London clay, *see* Clay

London Colney, N.W., surface geology and altitude, 74, 79

London district, soils and subsoils of, Mr. H. B. Woodward on, 2

London Fields, N.E., surface geology and altitude, 76

London Life Tables, use in showing annual gain or loss of life, 55

"London Spa," 43

Long Ditton, S.W., surface geology and altitude, 78

Lord, Dr., notes on Colwyn, 292, 293, 305, 307

Lordship Lane, Sydenham, S.E., surface geology and altitude, 78

Lordship Park, S.E., surface geology and altitude, 78

Loughborough (Leicestershire), meteorological tables, 185

Loughborough Park, S., surface geology and altitude, 76

Loughton, N.E., surface geology and altitude, 78, 79

Louisburgh, 514

Louth (County), *see* Carlingford, Clogher, Drogheda, Dundalk, Greenore, Omeath

Lowestoft, 100-105; anæmia benefited at, 105; anæmia rare at, 105; chief causes of death at, 105; diphtheria, amount of prevalence at, 104; drainage, 102; measles, amount of prevalence at, 103; meteorological observations, 85, 100, 101; phthisis (early) benefited at certain seasons, 105; sunshine at, 101; typhoid fever, amount of prevalence at, 104; water supply, 101; winds prevalent at, 101

Lucan, 416; sulphur spa at, 416

Lucas, Charles, on Lisdoonvarna mineral springs, 579

Ludgate Hill, an ancient health resort, 1

Lung (diseases), *see* Asthma, Bronchitis, Phthisis, Pleurisy, Pneumonia

Lynn (Lynn Regis or King's Lynn) and district, 112-118; anæmia prevalent in, 118; calculus, areas of prevalence and non-prevalence in, 115; gout not

Lynn—*continued*.

common, 118; malaria rare in, 118; phthisis prevalent, 114; water supply, 113, 114; *see also* Marshland

Lytham, 190; suitable for chronic kidney and pulmonary diseases, 190

MABLETHORPE, 118; unsuitable for invalids, 118

Macclesfield, meteorological tables, 181

MacComiskey, Dr. A. W. S., notes on Ardglass, 562

McDougall and Roscoe on carbonic acid in Manchester air, 25

Maguire, Dr. Robert, the climate of Lancashire, 187-191

Maida Vale, N.W., as a residence, 70; surface geology and altitude, 78

Malahide, 406; drainage, 407; kidney diseases rare at, 407; rheumatism rare at, 407; water supply, 407

Malaria:

absent at Achill Island and Doogort, 522; in Belfast, 555; at Cromer, 110; at Felixstowe, 93; at Galway, 506; at Leamington, 158; in Northumberland, Durham and Yorkshire, 272; at Swansea, 352; in Valentia Island, 485; at Woburn Sands, 162; (almost) in Lake District, 213

decreasing in Fishguard district, 372
disappearance (recent) in North Wales, 297, 322

occasional occurrence of, at Carmarthen, 360; at Clacton-on-Sea, 89; in Cork and neighbourhood, 451; in Lynn and Lynn district, 118; at The Mumbles, 355

question of present endemicity in London, 61-63

relapses induced at Southwold, 99

Malden, S.W., surface geology and altitude, 78

Malin Head, meteorological table, 539

Mallaranny, 517; suggested as a winter resort for cases of chronic bronchitis or phthisis, 518

Malldraeth, 318

Mallow, 453; baths and spa-house erected at Mallow in eighteenth century by Sir Denham Norreys, 453; sub-thermal spring at, 453

Malvern (Great), adenoids benefited at, 143,—rare at, 143; anæmia benefited at, 143; asthma benefited at, 143, 144,—rare at, 143; brine-baths obtainable by importation of Droitwich brine, 144; bronchitis (chronic) rare

Malvern (Great)—*continued*.

at, 143; calculus rare at, 143; catarrhs benefited at, 143,—rare at, 143; debility benefited at, 144; definition and physical character of district, 138; drainage of, 142; enlarged tonsils benefited at, 143; epidemic diseases rare at, 143; geology, 139; gout benefited at, 144; gravel rare at, 143; meteorological tables, 140, 141; meteorology of, 140–142; neuralgia rare at, 143; osteo-arthritis benefited at, 144,—rare at, 143; phthisis rare at, 143; pleurisy rare at, 143; pneumonia rare at, 143; renal dropsy (acute) rare at, 143; rheumatism benefited at, 143, 144; rheumatism (acute) rare at, 143; scrofula rare at, 143; skin diseases rare at, 143; tonsils (enlarged) rare at, 143; tuberculous diseases benefited at, 143, 144,—rare at, 143; water supply, 142; wind-exposure, 139

Malvern (North), *see* Malvern (Great)

Malvern (West), 139

Malvern Link, *see* Malvern (Great)

Malvern Springs, contain only traces of mineral ingredients, 144

Malvern Wells, *see* Malvern (Great)

Manchester air, carbonic acid in, 25

Manchester and Salford, air of, 22

Manor Park (Essex), E., surface geology and altitude, 76

Marlborough, meteorological tables, 177, 178

Marshland, *see* Alluvium

Marshland (Lynn district), calculus very rare in, 115; calculus, rarity of, connected with abundance of salt in water supply, 115, 117; water supply, 113, 114,—impregnated with salt, 113

Martin, Dr. J. C., notes on Portrush, 544

Marylebone, surface geology and altitude, 76

Massage, Valentine Greatorex an early exponent of, 444

Matlock, climate relaxing, 170

Mayfair, surface geology and altitude, 76

Mayo (County). *See* Achill Island, Ballina, Belmullet, Clare Island, Croagh Patrick, Doogort, Louisburgh, Mallaranny, Newport, Westport

Maze Hill, S.E., surface geology and altitude, 79, 80

Measles:

death-rate in London County, 1899, 57,—in Midland Counties, 134
serious epidemic of, at Lowestoft, 103,—at Valentia Island, 486

Meath (County), *see* Laytown

Meathop (near Grange), open-air sanatorium at, 217

Medicinal springs of Midland Counties, *see* Flitwick Chalybeate water; Shearsby Spring; *see also* Mineral Springs

Menai Straits, mild in winter, but exposed to cold damp winds, 316

Merriion, 409

Merton, S.W., surface geology and altitude, 76, 78,

Meteorological data of Greater London, 14, 15

Meteorological tables, Aberystwith, 375; Alnwick, 256, 277; Alston, 225; Apsley Guise, 160, 161; Aysgarth, 256, 280; Belmullet (Co. Mayo), 519; Belper, 169; Blackpool, 193; Bolton, 194; Bradford, 256, 282; Burghill, 183; Buxton, 167, 168; Cambridge, 186, Cardiff, 341; Carmarthen, 358, 359; Chaddle, 179, 180; Cheltenham, 147, 148; Colwyn Bay, 305, 306, 307; Cramlington, 256, 278; Donaghadee, 559; Enniskerry, 422, 423; Finchley, 12; Halifax, 256, 283; Hillington, 85; Hodsock, 182; Hull, 256, 284; Isleworth, 13; Kendal, 221; Kenilworth, 157, 158; Leamington, 157; Llandudno, 292, 311; Loughborough, 185; Lowestoft, 85, 100, 101; Macclesfield, 181; Malin Head, 539; Malvern, 140, 141; Marlborough, 177, 178; National Hospital for Consumption for Ireland, 429; Newton-Reigny, 226; Old Street (London), 10; Oxford, 185; Parsons-town (King's County), 418; Regent's Park (London), 11, 16; Rhyl, 302; Roche's Point (Cork Harbour), 457; Ross, 184; Rounton, 256, 279; St. Ann's Head, 364; St. David's, 366, 367; St. Michael-on-Wyre, 192; Scaleby, 227; Scarborough, 256, 281; Seathwaite, 228; Somerleyton, 85; Southwold, 96, 97; Stapleton, 229; Ushaw, 256, 285; Valentia Island, 483

Meteorology of Balbriggan, 408; of Buxton, 166; of Cheltenham, 146–149; of Clacton-on-Sea, 87; of Cork, 449; of Cromer, 109; of Dublin, 390–396; of East Coast, 84–86; of Felixstowe, 92; of Kingstown, 410; of Lake District, 203; of Lancashire, 187, 188; of Leamington, 156–158; of Greater London, 9–20; of Malvern, 140–142; of Midland Counties, 121–132; of Skerries, 408; of Ushaw, 262; of Valentia Island, 477; of North

Meteorology—continued.

- Wales, 289; of South Wales, 335-337; of Woburn Sands, 160; of Great Yarmouth, 106-108. *See also* Meteorological Tables
- Middlesex, County, 1-80; mortality, from all causes, 63; from cancer, 63, —diseases of circulatory system, 64, —of digestive system, 64, —of nervous system, 65, —from phthisis, 64, —from diseases of respiratory system, 64, —of urinary system, 64. *See* Finchley, Isleworth
- Middlesex Convalescent Home, Clacton-on-Sea, 89
- Midland Counties, 119-186; climate, table showing chief points of interest, 130; cloud, amount of, 124, —table of amount, 125; configuration of district, 119; death-rate, generally low except in manufacturing counties, 132; *see* Cheshire, Nottinghamshire, Staffordshire, Warwickshire, —from cancer, 135, 136, —from diarrhoea, 134, —from measles, 134, —from phthisis, 134, 135, —from puerperal fever, 134, —from typhoid fever, 134, —from whooping-cough, 134; definition of district, 119; elevation, 120; geology, 120; health (general) of district, 132; humidity, 127, —tables of, 127; medicinal springs of, 171-173; *see also* Flitwick Chalybeate water, Shearsby Spring; meteorology, 121-132; rainfall, 127-129, —tables of, 123, 129; sunshine, 125, —less abundant than at sea-coast stations, 125, —tables of, 125, 126; temperature, 122, —of inland stations colder in winter and hotter in summer, than those on sea-coast, 123, —cooler than London in summer, 129, 131, —tables of, 122, 123, 124
- Mildmay Park, surface geology and altitude, 80
- Mile End, E., surface geology and altitude, 76
- Mile End Old-town, crude and corrected death-rates, 53; death-rate from phthisis, 60
- Mill Hill, N.W., surface geology and altitude, 78, 79
- Mill Hill Park (Acton), surface geology and altitude, 76
- Milton Park, Highgate, N., surface geology and altitude, 78, 79
- Milton Malbay, 499; rainfall table, 500
- Mimms, North, N., surface geology and altitude, 74, 76
- Mimms, South, N., surface geology and altitude, 74, 76, 78, 79, 80
- Minchinhampton and Minchinhampton Common, 153; phthisis benefited at, 155, —rare at, 154; scrofula and tuberculous diseases rare at, 154
- Mineral ingredients only present in traces in Malvern Springs, 144
- Mineral springs: Dunkineely, sulphur, 533; Flitwick, chalybeate, 172; Kilkee, iron, salts of sodium, etc., 499; Kinlough, hydrogen sulphide, 532; Leixlip, 416; Lisdoonvarna, chalybeate and sulphur, 496, 501, 578-586; London spas (ancient), 42, 43; Lucan, sulphur, 416; Mallow, sub-thermal, 453; Shap, calcium chloride, sodium chloride, etc., 220; Shearsby, chloride and sulphate of sodium, etc., 173; Trefriw, chalybeate, 327; Tunbridge Wells, chalybeate, 172
- Minerals of Durham, 233; of Ireland, 383; in Lake District, 200; of Northumberland, 233; of Yorkshire, 234
- Mist in London diminished by building, 33
- Mist and smoke accumulation, mutual influences, 32
- Mitcham, S.W., surface geology and altitude, 76
- Molesey, S.W., surface geology and altitude, 76
- Monk Wearmouth, 261
- Monken-Hadley, N., surface geology and altitude, 79
- Monkstown, 409
- Monkstown (Co. Cork), 455
- Moore, Sir John W., the climate of Ireland, 381-577
- Moore, Dr. Norman, on Ludgate Hill as an early health resort, 1; the mineral springs of Ireland, 578-586
- Moorfields, surface geology and altitude, 76
- Morden, S.W., surface geology and altitude, 78
- Morecambe, 189; Bright's disease benefited at, 189; bronchitis (chronic), benefited at, 189; nerve-excitement benefited at, 189
- Morris, Dr. Jones, notes on Portmadoc, 322
- Mortality of Belfast in 1899, 555; of Essex, 63; of England and Wales, 63; of Kent, 63; in Lake District, 213; of London County, 51-54, —of its various sanitary districts, 52, 53; of Middlesex, 63; of Surrey, 63; of Sussex, 63; *see also* under names of

Mortality—*continued*.

Localities and Special Diseases; greatly increased by fog, 27

Mortality tables of bronchitis and catarrh at Carmarthen, 359; of phthisis at Carmarthen, 359; of pneumonia at Carmarthen, 359; of Kendal, 221; of Tenby, 362

Mortlake, S.W., surface geology and altitude, 76

Mottingham, surface geology and altitude, 78, 79

Mountainous region of South Shropshire, 170; *see also* Church Stretton

Mountains and hills over 1,000 feet above sea-level in Lake District, 199

Mourne Mountains, 567

Moville, 538; rainfall of, 538

Mullaghmore, 529; sea-bathing good, 529

Mumbles (The), anæmia and debility not benefited at, 355,—uncommon at, 355; bronchitis not benefited at, 355; broncho-pneumonia not uncommon, 355; catarrh not benefited at, 355; causes of death, 355; diarrhoea rare, 355; diphtheria rare, 355; drainage and water supply, 355; kidney diseases rare, 355; malaria not unknown at, 355; neuralgia common, 355; phthisis, amount of prevalence, 355; rheumatism prevalent, 355; scarlet fever, amount of prevalence, 355; scrofula rare, 355; skin diseases (except eczema) rare, 355; tubercular diseases rare, might benefit at, 355

Mundesley-on-Sea, 111; open-air sanatorium at, 111

Munro, Dr. J. M. H., report on the chemical composition of the Lisdoonvarna Springs, 581-586

Muriated and sulphated waters (ancient), Beulah Spa, 43

Murphy, Mr. Shirley, on death-rate in County of London for various ages, 55

Murrell, Dr. William, report on the East Coast, 81-114

Muswell Hill, N., surface geology and altitude, 74, 79

NATIONAL HOSPITAL for Consumption for Ireland, 428; meteorological observations at, 429

Neaden, N.W., surface geology and altitude, 78

Nerve-exhaustion benefited at Morecambe and Grange, 189

Nervous system, diseases of, mortality from, in England and Wales, 65; in

Nervous system, diseases of—*continued*.

Essex, 65; in Kent, 65; in London County, 65; in Middlesex, 65; in Surrey, 65; in Sussex, 65

Neuralgia:

benefited by Achill Island and Doogort, 522

East Coast generally unfavourable to, 86

not benefited by Dovercourt, 90

amount of prevalence at Cardiff, 343; at Galway, 506; at The Mumbles, 355; at Tenby, 362

prevalent at Aberystwith, 378; at Ardglass, 563; in Belfast, 555; at Carmarthen, 360; at Cheltenham, 150; at Clacton-on-Sea, 89; in Cork and neighbourhood, 451; in first arrivals at Felixstowe, 93; (generally) in Lake District, 212; at Leamington, 158; in Northumberland, Durham and Yorkshire, 272; at Southwold, 99; at St. David's, 368; in Valentia Island, 485

rare at Malvern, 143; at Pwllheli, 320; at Woburn Sands, 162

Neuritis, East Coast generally unfavourable to, 86

Neurotic and delicate patients benefit at Leamington, 159

Nevin, asthma prevalent, 319; drainage and water supply, 319; promotes convalescence, 319; tuberculosis decreasing, 319

New Cross, S.E., surface geology and altitude, 76, 78, 80

New Malden, S.W., surface geology and altitude, 78

New Quay (Wales), 374

New River Company, 39; source of supply, 39

New Wells, 43

Newcastle (Ireland), 565-568

Newgal, 365

Newington, crude and corrected death-rates, 53; death-rate from phthisis, 60

Newington Butts, S., surface geology and altitude, 76

Newington Green, N., surface geology and altitude, 76, 80

Newport (Ireland), 516

Newport (Wales), 373

Newry, 571

Newton-Reigny, meteorological tables, 226

Newtownards, 560

Nicol (Dr.), notes on Llandudno, 291, 312

- Noel Park, Woodgreen, N., surface geology and altitude, 78
- Norbiton. S.W., surface geology and altitude, 78
- Norbury (Streatham), S., surface geology and altitude, 76, 78
- Norfolk; *see also* Cromer, Hunstanton, Lynn, Mundesley-on-Sea, Overstrand, Sidestrand, Trimmingham, Wells-next-the-Sea, Yarmouth (Great); calculus, prevalence and distribution of, 115-117; surface and geological formation, 83
- Norreys, Sir Denham, erected baths and spa-house at Mallow in eighteenth century, 453
- North Downs (south-east of London), phthisis benefits in warm and sunny situations among, 72
- North Malvern; *see under* Malvern (Great)
- Northold, surface geology and altitude, 78
- Northumberland, drainage (natural), 236; geology, 233; health resorts and other localities; *see* Alnmouth, Alnwick, Bamburgh, Berwick-on-Tweed, Cramlington, Cullercoats, Shields (North), Spittal, Tynemouth, Tweedmouth, Whitley; meteorological tables, *see* Alnwick, Cramlington; minerals, 233; physical features, 232; soils, 235. *See also* Northumberland, Durham and Yorkshire
- Northumberland, Durham and Yorkshire, 230-285
- anæmia prevalent, 270, 271; asthma, occurrence of, 271
- barometric pressure, 256, 257
- bracing climate of coast and inland resorts benefits only naturally healthy subjects, 275, 276
- bronchitis prevalent, 270
- calculus rare, 270
- climate, 239-244: in spring, 248; summer, 250; autumn, 252; winter, 254; as affected by ocean currents, 238
- cloud: in spring, 249; summer, 251; autumn, 253; winter, 254
- (coast resorts), anæmia not benefited at, 275; children benefited at, 275; eczema often aggravated by, 275; generally unsuited for diseases of respiratory system, 275, 276; kidney disease not benefited by, 275; rheumatism not benefited by, 275; sea-bathing at, benefits children, 275
- diarrhoea, amount of prevalence, 272
- Northumberland, etc.—*continued*.
- diphtheria, amount of prevalence, 272
- drainage (natural), 236
- eczema, amount of prevalence, 272
- fog, 247
- gravel, rare, 270
- hæmoptysis, rare, 271
- humidity, 244: in spring, 249; summer, 251; autumn, 253; winter, 255
- kidney disease, amount of prevalence, 270
- malaria absent, 272
- mortality, principal causes of, 274
- neuralgia prevalent, 272
- old age, distribution of, 274
- phthisis, amount of prevalence, 271; phthisis (fibroid), frequent occurrence of, 271
- physical characters (general), 230-236
- pleurisy prevalent, 270
- pneumonia prevalent, 270
- rainfall, 244: in spring, 249; summer, 251; autumn, 253; winter, 255
- rheumatism (acute and chronic) prevalent, 270, 271
- rheumatoid arthritis, amount of prevalence, 271, 272
- rickets markedly absent, 273
- scarlet fever, amount of prevalence, 272
- scrofula, amount of prevalence, 271
- skin diseases (except eczema), rare, 272
- soils, 235
- sore throat (endemic), amount of prevalence, 272
- sunshine, 246, 247
- temperature, 244: in spring, 248; summer, 250; autumn, 252; winter, 254
- tuberculous diseases of joints and glands, amount of prevalence of, 271
- typhoid fever, amount of prevalence of, 272
- vegetation, 237
- winds, 245, 246: in spring, 249; summer, 252; autumn, 253; winter, 255
- Northwood, surface geology and altitude, 80
- Norwood, 78
- Norwood (Lower), as a residence, 68
- Norwood (Upper), metropolitan health resort, 72

- Notting Hill, N.W., as a residence, 70 ; surface geology and altitude, 76, 78
- Nottinghamshire, death-rate one of highest in Midland Counties, 132
- Nunhead, S.E., surface geology and altitude, 78
- OAKLEIGH PARK, East Barnet, N., surface geology and altitude, 78, 79
- Ocean currents, effect on climate of Durham, 238,—of Northumberland, 238,—of North Wales, 295,—of Tenby, 361,—of South Wales, 330, 333-335,—of Yorkshire, 238
- Ockendon, North, E., 76
- Ockendon, South, E., surface geology and altitude, 76
- O'Halloran, Sylvester, on Lisdoonvarna mineral springs, 579
- Old Ford, N.E., surface geology and altitude, 76, 80
- Old Street (London), meteorological records, 10
- O'Mahony, Mr. John, on County Kerry, 468
- Omeath, 572
- Open-air treatment of phthisis at Cotswold Sanatorium, 155 ; at Mundesley-on-Sea Sanatorium, 111 ; *see also* Sanatoria
- Oravy Park, surface geology and altitude, 78, 79, 80
- Osteo-arthritis :
benefited at Malvern, 144
not benefited by Lake District, 217
uncommon at Cheltenham, 150 ; at Malvern, 143
- Osterley Park, W., surface geology and altitude, 76, 80
- Oughterard, 508
- Overcrowding in lodgings at Cromer, 111
- Overstrand (near Cromer), 111
- Overwork, sufferers from, with insomnia, benefited at Kilmore Quay, 435
- Ovoca. *See* Vale of Ovoca
- Oxford, meteorological tables, 185 ; sunshine tables, 174
- Oxshott, Esher, S.W., surface geology and altitude, 78, 79
- Oxwich, 356
- PADDINGTON, W., as a residence, 70 ; crude and corrected death-rates of, 53 ; death-rate from phthisis, 60 ; favourable to rheumatism, 71 ; surface geology and altitude, 76
- Page Green, Tottenham, N., surface geology and altitude, 78
- Pakefield (Lowestoft), 100
- Palmer's Green, N., surface geology and altitude, 76, 78
- Parknasilla, 471-473 ; climate remarkably mild, 472 ; indicated as a winter and spring resort for respiratory diseases, 472
- Parliament Hill, N., surface geology and altitude, 78
- Parson's Green, surface geology and altitude, 76, 80
- Parsonstown (King's County), meteorological tables, 418
- Passage (West), 455
- Peak District of Derbyshire, 165-170 ; High Peak District, 165 ; *see also* Buxton ; Lower Peak District, 166 ; *see also* Bakewell, Belper, Matlock
- Peard, Dr., on Roundstone, 510
- Peckham, S., surface geology and altitude, 76, 80
- Peckham Rye, S.E., surface geology and altitude, 80
- Penarth, 348
- Penge, S.E., surface geology and altitude, 78
- Peninsula of Ards, 559
- Peninsula of Gower, advantages of, as a health resort, 357 ; climate, 354 ; physical configuration, 353 ; prevalence of disease, *see* Mumbles (The) ; rainfall, 354. *See also* Bracelet Bay, Caswell Bay, Langland Bay, Oxwich, Port Eynon, Mumbles (The)
- Penmaenmawr, climate of, 314 ; drainage and water supply, 315 ; not a winter resort, 314
- Pensarn, 303
- Perivale, surface geology and altitude, 76
- Pertussis ; *see* Whooping Cough
- Petersham, surface geology and altitude, 76
- Phthisis :
benefited at Aberystwith, 377 ; at Ardglass in summer, 562 ; at Ascot, 164 ; at Barmouth, 324 ; at Beaumaris, 316 ; at Caswell Bay, 355 ; at Clacton-on-Sea, 89 ; at Colwyn Bay in winter, 308 ; at Dovercourt (in early stages only), 90 ; on East Coast (in early stages only), 86 ; at Glengarriff in some cases, 466 ; at Kilmore Quay, 435 ; at Langland Bay, 355 ; at Llandudno, 313 ; at Lowestoft (at certain seasons and in early stages only), 105 ; at Minehin-hampton Common, 155 ; at Rhyl, 302 ; at Southport in advanced

Phthisis—continued.

stages, 190 ; at Southwold from May to October, 99 ; at Tenby, 363 ; in Vale of Clwyd, 328 ; at Wells-next-the-Sea in summer, 112 ; at Woburn Sands, 162 ; (possibly) on Yorkshire coast resorts in summer and early autumn (in early stages only), 275 ; *see also* Saltburn

not benefited at Blackpool, 189 ; at Swansea, 351

Chelsea unfavourable to phthisis among poorer classes, 69

death-rate in London County decreasing, 59-61 ; in Midland Counties, 134, 135

decreasing at Cardiff, 342, 348 ; at Swansea, 351

influence of drainage on, in South Wales, 380 ; of humidity on, in South Wales, 380

mortality from, in England and Wales, 64 ; in Essex, 64 ; in Kent, 64 ; in London County, 64 ; in Middlesex, 64 ; in Surrey, 64 ; in Sussex, 64 ; mortality tables at Carmarthen, 359

North Downs (south-east of London) suitable for, 72

open-air treatment at Altadore Sanatorium, 427 ; at Cotswold Sanatorium, 155 ; at Meathop Sanatorium (near Grange), 217 ; at Mundesley-on-Sea, 111 ; at National Hospital for Consumption for Ireland, 428 ; at Rosselare Sanatorium (Co. Fermanagh), 529-31 ; at Rostrevor Sanatorium, 570

amount of prevalence at Aberystwith, 377 ; at Ardglass, 562 ; at Buncrana, 537 ; at Carmarthen, 359 ; at Criccieth, 321 ; at Cromer, 110 ; in Eden Valley (Lake District), 199 ; in Fishguard district, 371 ; in Lake District, 211, 212 ; in Lynn and Lynn district, 114 ; at The Mumbles, 355 ; in Northumberland, Durham and Yorkshire, 271 ; at Pwllheli, 320 ; at St. David's, 368 ; at Seaham, 261

prevalent in coast villages of Anglesey, 317 ; in Belfast, 555 ; in Cork and neighbourhood, 450 ; at Galway, 505, 506 ; in Isle of Man, 224 ; in North Wales, 297-299 ; at Portmadoc, 322 ; at Tenby, 362 ; in South Wales, 380

Phthisis—continued.

uncommon at Achill Island and Doogort, 522 ; at Barmouth, 324 ; at Beaumaris, 316 ; at Cheltenham, 150 ; at Clacton-on-Sea, 88 ; at Colwyn Bay, 308 ; at Dovercourt, 90 ; at Enniscrone, 525 ; at Felixstowe, 93 ; at Leamington, 158 ; at Llandudno, 312 ; at Malvern, 143 ; at Minchinhampton, 154 ; at Rhyl, 302 ; at Southwold, 98 ; at Tramore, 439 ; (very) at Valentia Island, 485 ; at Woburn Sands, 162

(fibroid) prevalent in Northumberland, Durham and Yorkshire, 271

Pimlico, S.W., surface geology and altitude, 75, 76

Pinner, N.W., surface geology and altitude, 76, 78, 80

Plaistow, E., surface geology and altitude, 76

Pleurisy :
 amount of prevalence at Achill Island and Doogort, 522 ; at Cardiff, 343 ; in Cork and neighbourhood, 450 ; in Fishguard district, 371 ; at Leamington, 158 ; at St. David's, 368

prevalent in Belfast, 555 ; at Buncrana, 537 ; in Northumberland, Durham and Yorkshire, 270 ; at Swansea, 352

uncommon at Aberystwith, 377 ; at Ardglass, 563 ; at Cheltenham, 150 ; at Clacton-on-Sea, 88 ; at Cromer, 110 ; at Enniscrone, 525 ; at Galway, 506 ; in Lake District, 212 ; at Malvern, 143 ; at Southwold, 98 ; at Valentia Island, 485 ; at Woburn Sands, 162

Plowright, Dr. C. B., on prevalence of phthisis in Lynn and Lynn district, 114 ; on prevalence and distribution of calculus in Norfolk, 115-117

Plumstead, S.E., crude and corrected death-rates, 53 ; death-rate from phthisis, 60 ; surface geology and altitude, 79

Plumstead Marshes, S.E., surface geology and altitude, 75

Plumstead, north of, S.E., surface geology and altitude, 74

Plunkett and Studdert (Messrs.), analyses (1874) of Lisdoonvarna Springs, 581-585

Pneumonia, convalescents from, benefit at Enniscrone, 525

Pneumonia—continued.

- death-rate in London county, 1899, 59
 amount of prevalence at Achill Island and Doogort, 522; in Belfast, 555; at Cardiff, 343; at Carmarthen, 359; at Cheltenham, 150; in Cork and neighbourhood, 450; in Fishguard district, 371; in Lake District, 212; at St. David's, 368; at Southwold, 98
 prevalent at Buncrana, 537; in Dublin, 396; at Lowestoft, 105; in Northumberland, Durham and Yorkshire, 270; at Swansea, 352; at Tenby, 362
 uncommon at Aberystwith, 377; at Ardglass, 563; at Clacton-on-Sea, 88; at Cromer, 110; at Enniscrone, 525; at Galway, 506; at Llandudno, 312; at Malvern, 143; at Valentia Island, 485; at Woburn Sands, 162
 (unresolved) benefited by Enniskerry, 420
 Ponder's End, surface geology and altitude, 76
 Poplar, E., 71; crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 76
 Portaferry, 560
 Port Eynon, 356
 Porthcawl, 350
 Portmadoc, cancer and phthisis prevalent at, 322, 323; rainfall, 323
 Portrush, 543-546; its value as a health resort, 546; drainage, 545; sea-bathing good, 546; water supply, 544, 545
 Portsalon, 535; sea-bathing good, 536
 Portstewart, 543; sea-bathing good, 543
 Power, Dr. J. Byrne, on the climate of Kingstown, 410
 Prestatyn, drainage, 301; water supply, 301
 Primrose Hill, N., surface geology and altitude, 78
 Puerperal fever:
 prevalent in Lake District, 216
 death-rate in Midland Counties, 134
 Putney, S.W., metropolitan health resort, 72; surface geology and altitude, 76, 78
 Pwllheli, anæmia rare, 320; bronchitis and catarrh common, 320; climate, 320; scrofula, amount of prevalence, 320; diphtheria and scarlatina, amount of prevalence, 320; drainage, 320;

Pwllheli—continued.

- kidney diseases rare, 320; liver and gastro-intestinal troubles common, 320; neuralgia rare, 320; phthisis, amount of prevalence, 320, 321; rheumatism rare, 320; tubercular diseases, amount of prevalence, 320,—decreasing, 320; typhoid fever very rare, 320
 QUEEN'S COLLEGE, Galway, 507
 Queen's Park, Kilburn, N.W., surface geology and altitude, 78
 Queenstown, 456-458; climate, 458; recommended for convalescents from acute diseases, 458; for throat affections (chronic catarrhal), 458
 Quinlan, Dr., on Mallaranny as a winter health resort, 518
 RADIATION, influence on fog in London, 35
 Rain, in country districts purer than in London, 24; impurities in London rain, 23
 Rainfall at Barmouth, 289, 324; at Belfast, 555, 556; at Bellarena, 542; at Cardiff, 341; at Carrickfergus, 552; at Cheltenham (small), 146; at Derry (City), 542; at Dublin, 391, 392; at Dundalk, 574; of Durham, 244,—in spring, 249,—in summer, 251,—in autumn, 253,—in winter, 255; at Greenore, 573; at Greystones, 425; in Isle of Man, 223; at Killarney, 493, 494; of Lake District, 205; at Llandudno, 289, 311, 312; of Midland Counties, 127-129; at Moville, 538; of Northumberland, 244,—in spring, 249,—in summer, 251,—in autumn, 253,—in winter, 255; in Peninsula of Gower, 354; at Rhyl, 300; at Tenby, 361; in Vale of Clwyd, 328; at Valentia Island, 480; in North Wales, 289; on South Wales coast, 337-339; at Warrenpoint, 571; at Waterford, 438; of Westmorland, 206; of Yorkshire, 244,—in spring, 249,—in summer, 251,—in autumn, 253,—in winter, 255
 Rainfall tables: Appleby, 207; Barrow, 209; Bray, 419; Castletownshend (Co. Cork), 462; Coniston, 209; Cork, 452; Elterwater, 207; Grange, 209; Greystones, 426; Kerry Co., extreme south-west district, 494; Killiney, 415; Midland Counties, 128, 129; Miltown Malbay, 500; Roundwood (Co. Wicklow), 399, 400; Shap, 207; Windermere, 207. *See also* Meteorological Tables

- Ratcliff, E., surface geology and altitude, 76
- Rathbawn chalybeate well (Lisdoonvarna), analysis, 585; mild chalybeate or "magnesia" well (Lisdoonvarna), analysis, 586
- Rathlin Island, 547
- Rathmullan, 536
- Ravensbourne Park (Catford), S.E., surface geology and altitude, 76, 78
- Ravenscourt Park, W., surface geology and altitude, 80
- Raynes Park, S.W., surface geology and altitude, 78
- Recess (Connemara), 508; geology, 509
- Redcar, 264; drainage, 264; sea-bathing at, 264
- Red Wharf Bay, 317
- Regent's Park, N.W., dampness of, 70; meteorological records, 11, 16; surface geology and altitude, 78
- Reid, Dr. A., notes on Tenby, 362
- Relaxing health resorts of Ireland, 388
- Renal diseases. *See* Kidney (diseases)
- Respiratory system (diseases of), mortality from, in England and Wales, 64; in Essex, 64; in London County, 64; in Middlesex, 64; in Surrey, 64; in Sussex, 64
- Northumberland, Durham and Yorkshire coast resorts generally unsuited for, 275, 276
- Rheumatism:
- Battersea unfavourable to, among poorer classes, 68
 - benefited at Blackheath, 72; at Brompton, 71; at Clapham, 71; at Kensington (some districts), 71; at Malvern, 143, 144; at Paddington, 71; at Rhyl, 302; (possibly) by Shearsby Spring, 173; at Shepherd's Bush, 71; at Wandsworth (upper district), 71; at Woburn Sands, 162
 - not benefited at Achill Island and Doogort, 522; at Dovercourt, 90; at Filey, 268; at Northumberland, Durham and Yorkshire coast resorts, 275
 - Chelsea unfavourable to rheumatism among poorer classes, 69
 - Chislehurst unsuitable as residence for, 72
 - clay soil allowable for residence when surface undulating, 71
 - East Coast generally unfavourable to, 86
 - amount of prevalence at Ardglass, 563; at Cardiff, 343; at Galway, 506; at Valentia Island, 485
 - prevalent at Aldeburgh, 94; in Belfast, 555; at Carmarthen, 360; at Criccieth, 322; in Fishguard district, 372; at Glengarriff, 467; at The Mumbles, 355; in Northumberland, Durham and Yorkshire, 270; at St. David's, 368; at Southwold, 99; in South Wales, 379
 - residence by river contra-indicated in, 71
 - uncommon at Aberystwith, 378; at Barmouth, 324; at Colwyn Bay, 308; at Llandudno, 312; at Malahide, 407; at Pwllheli, 320; at Tenby, 362; at Tramore, 439
 - Wimbledon contra-indicated as residence for, 72
- (acute), amount of prevalence in Northumberland, Durham and Yorkshire, 271
- prevalent in Cork and neighbourhood, 451; at Cromer, 110
- rare at Cheltenham, 150; at Clacton-on-Sea, 89; (generally) in Lake District, 212; at Leamington, 158; at Malvern, 143; at Woburn Sands, 162
- (chronic) benefited by Enniscrone, 525
- amount of prevalence in Northumberland, Durham and Yorkshire, 271, 272
- prevalent in Cork and neighbourhood, 451; at Felixstowe, 93
- (muscular), amount of prevalence at Woburn Sands, 162
- prevalent at times at Cheltenham, 150; at Leamington, 158
- Rhoscolyn, 318
- Rhosnegir, 318
- Rhyl, asthma not benefited at, 302; climate, 301; drainage, 302; favourable for children, 302; hæmoptysis rare at, 302; meteorological tables, 302; phthisis benefited at, 302;—uncommon at, 302; rainfall, 300; rheumatism benefited at, 302; water supply, 302
- Richmond (Surrey), S.W., surface geology and altitude, 76, 78
- Richmond (Yorks), 262, 263
- Rickets absent (markedly) in Northumberland, Durham and Yorkshire, 273
- Rivers, depletion due to London water supply, 41

- Rivers and lakes of Lake District, 197
 Riverside residence contra-indicated in rheumatism, 71
 Roberts, Dr. Lloyd, notes on Denbigh, 297
 Robin Hood's Bay, 266
 Roche's Point (Cork Harbour), meteorological table, 457
 Roehampton, S.W., surface geology and altitude, 76, 78
 Roker, 261; sea-bathing at, 261; sea-side resort for Sunderland, 261
 Romford, E., surface geology and altitude, 76, 78
 Rosapenna, 534
 Roscoe and McDougall on carbonic acid in Manchester air, 25
 Ross, meteorological tables, 184
 Rosscarbery, 461
 Rossclare Sanatorium, 529-531
 Rosses Point, 527, 528; sea-bathing good at, 528
 Rosslare, 433
 Rosslyn Park, Hampstead, N.W., surface geology and altitude, 78, 79
 Rostrevor, 569
 Rostrevor Sanatorium, 570
 Rotherhithe, crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 75
 Roundstone, 510
 Roundwood (Co. Wicklow), rainfall, in relation to Dublin water supply, 399, 400
 Rounton, meteorological table, 256, 279
 Roxeth, Harrow, N.W., surface geology and altitude, 78
 Royal Northern Sea-Bathing Infirmary, Scarborough, 267; homes and principal diseases of patients, 273
 Royal Society, one of its founders, Hon. Robert Boyle, born at Lismore, 445
 Ruislip, N.W., surface geology and altitude, 78, 80
 Rushey Green, Catford, S.E., surface geology and altitude, 76
 Russell, Dr. J. B., on necessity of smoke prevention, 27; on infantile diarrhoea, mortality in Glasgow, 58
 Russell, Hon. Rollo, on necessity of smoke prevention, 27; on mode of production of fogs in London, 33-35
 Russell, Dr. W. J., F.R.S., on London air, 20, 21, 22; on London rain, 23; on increase of mortality from fog, 27
 Rutty, Dr. John, *Methodical Synopsis of Mineral Waters* (1757), 578, 579
 SADLERS WELLS (ancient), chalybeate, 42
 St. Ann's Head, meteorological tables, 364
 St. Anne's, 190; kidney diseases (chronic) benefited at, 190; lung diseases (chronic) benefited at, 190
 St. Anne's Hill Hydropathic Establishment, Blarney, 454
 St. Bees, 201
 St. Bride's Bay, 365
 St. David's, anaemia common at, 368; asthma rare at, 368; bronchitis and catarrh prevalent at, 368; commonest causes of death, 368; conducive to old age, 369; diarrhoea rare at, 368; diphtheria rare at, 368; drainage, 369; endemic sore throat prevalent at, 368; kidney diseases, amount of prevalence at, 368; meteorological tables, 366, 367; not a resort for invalids, 369; phthisis, uncommon at, 368; pneumonia and pleurisy, amount of prevalence at, 368; rheumatism, arthritis and neuralgia common at, 368; scarlet fever absent at, 368; scrofula rare at, 368; skin diseases (except eczema) rare at, 368; tubercular disease rare at, 368; typhoid fever rare at, 368; water supply, 369
 St. George, Hanover Square, crude and corrected death-rates, 53; death-rate from phthisis, 60
 St. George-in-the-East, crude and corrected death-rates, 53; death-rate from phthisis, 60
 St. George, Southwark, crude and corrected death-rates 53; death-rate from phthisis, 60
 St. George's Field Spa, sulphuretted, 43
 St. Giles, crude and corrected death-rates, 53; death-rate from phthisis, 60
 St. James (Westminster), crude and corrected death-rates, 53; death-rate from phthisis, 60
 St. James' Park, surface geology and altitude, 75, 76
 St. John's (Lewisham), S.E., surface geology and altitude, 76, 80
 St. John's Wood, N.W., surface geology and altitude, 78
 St. Luke, crude and corrected death-rates, 53; death-rate from phthisis, 60
 St. Margaret's (Twickenham), S.W., surface geology and altitude, 76
 St. Martin-in-the-Fields, crude and corrected death-rates, 53; death-rate from phthisis, 60
 St. Mary Cray, surface geology and altitude, 76, 79
 St. Marylebone, crude and corrected

St. Marylebone—continued.

death-rates, 53; death-rate from phthisis, 60

St. Michael-on-Wyre, meteorological tables, 192

St. Olave, crude and corrected death-rates, 53; death-rate from phthisis, 60

St. Pancras, N., crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 78

St. Pancras and St. Chad, wells of, 42

St. Paul's Cray, surface geology and altitude, 76, 79

St. Quintin's Park, N.W., surface geology and altitude, 78

St. Saviour, Southwark, crude and corrected death-rates, 53; death-rate from phthisis, 60

Salford and Manchester, air of, 22

Saline waters (ancient), Baguigge Wells, 42; Lambeth Wells, 43

Salt in water supply of Marshland (Lynn district), 113

Saltburn, 264, 265; baths at, 265; climate both bracing and mild, 265; phthisis in early stages benefited by, 275; water supply, 265

Salthill, suburb of Galway, 505

Sanatoria for the treatment of phthisis:

Altadore Sanatorium, 427

Cotswold Sanatorium, 155

Meathop (near Grange), 217

Mundesley-on-Sea, 111

National Hospital for Consumption for Ireland, 428

Rosclare Sanatorium (Co. Fermanagh), 529-531

Rostrevor Sanatorium, 570

Sand: valley gravel and sand districts in County of London and Greater London, 75-77; see also Bagshot Beds, Thanet Beds, Woolwich and Reading Beds

Sandymount, 409

Sanitation of Scarborough, 267

Scaleby, meteorological tables, 227

Scarborough, 266, 267; climate of, 267; drainage, 267; meteorological tables, 256, 281; Royal Northern Sea-Bathing Infirmary, 267, 273; sanitation, 267; water supply, 267

Scarlet fever:

death-rate in London County, 1899, 57

decreasing at Cardiff, 345, 348

amount of prevalence at Achill Island and Doogort, 522; at Cheltenham, 150; in Cork and neighbourhood, 451; at Cromer,

Scarlet fever—continued.

110; in Lake District, 213; at Leamington, 158; at The Mumbles, 355; in Northumberland, Durham and Yorkshire, 272; at Swansea, 352; at Valentia Island, 485; in North Wales, 299; at Woburn Sands, 162

prevalent in Belfast, 555; at Carmarthen, 360; (mild type) at Felixstowe, 93

uncommon at Aberystwith, 378; at Ardglass, 563; at Beaumaris, 317; in Fishguard district, 372; at Galway, 506; at Glengarriff, 466; at Llandudno, 313; at Southwold, 99; at Pwllheli, 320

Scott, Dr. H. M., notes on Enniscrone, 525

Scrofula:

benefited at Cromer, 110; at Dovercourt, 90; at Kilmore Quay, 435 amount of prevalence at Aberystwith, 377; at Cardiff, 341; at Criccieth, 321; at Galway, 505; at Nevin, 319; in Northumberland, Durham and Yorkshire, 271; in Lake District, 211; at Pwllheli, 320

prevalent in Belfast, 555; in Cork and neighbourhood, 450

uncommon at Ardglass, 562; at Buncrana, 537; at Clacton-on-Sea, 88; at Colwyn Bay, 307; at Cromer, 110; at Fishguard, 371; in Llanelly district, 359; at Malvern, 143; at Minchinhampton, 154; at The Mumbles, 355; at St. David's, 368; at Swansea, 351; at Tenby, 362; at Valentia Island, 485; at Woburn Sands, 162

unknown (almost) at Achill Island and Doogort, 522; at Felixstowe, 93; at Southwold, 98. See also Tubercular diseases

Scurvy: "dry scurvy" prevalent at Glengarriff in children, 467

Sea-bathing at Ballycastle, 547; at Donaghadee, 558; at Glenarm, 550; at Greyston-s, 424; at Helen's Bay, 556; at Killybegs, 533; at Laytown, 577; at Llandudno, 313; at Mullaghmore, 529; on Northumberland, Durham and Yorkshire coasts, 275; at Portrush, 546; at Portsalon, 536; at Portstewart, 543; at Redcar, 264; at Roker, 261; at Rosses Point, 528; at Seaton Carew, 261

- Sea-coast : sunshine more abundant than at inland stations, 125 ; temperature less cold in winter and less hot in summer than at inland stations, 123 ; temperature on coast of Wales, 334
- Seaham, 261 ; diarrhoea, amount of prevalence, 261 ; diphtheria, amount of prevalence, 261 ; drainage, 261 ; lung affections, amount of prevalence, 261 ; phthisis, amount of prevalence, 261 ; typhoid fever, amount of prevalence, 261 ; water supply, 261
- Seapoint, 409
- Seascale, 201
- Seathwaite, meteorological tables, 228
- Seaton Carew, 261, 262 ; sea-bathing at, 261
- Selhurst (Croydon), S., surface geology and altitude, 76, 78, 79
- Sewage, pollution of river Brent by, 41, 50 ; of river Lea by, 41, 48, 50
- Sewers and sewerage of London, 44, 46-51 ; amount dealt with yearly, and cost of, 50 ; defects in system and remedies proposed, 47 ; extension proposed, 46, 47 ; question of disposal of sewage in suburban areas, 49
- Shacklewell, surface geology and altitude, 76, 78
- Shadwell, E., surface geology and altitude, 76
- Shadwell Spa (ancient), 43
- Shannon (The), 495
- Shap, climate of district, 222 ; rainfall table, 207
- Shap Wells, 220 ; calcium chloride and sodium chloride principal ingredients of, 220
- Shearsby Spring, chloride and sulphate of sodium principal ingredients of, 173 ; rheumatism, gout, eczema (possibly) benefited by, 173
- Sheen, East, S.W., surface geology and altitude, 76
- Sheffield : amount of coal consumed in Sheffield compared with that used in London, 30
- Shenley, N.W., surface geology and altitude, 79
- Shepherd's Bush, W., rheumatism benefited by residing at, 70, 71 ; surface geology and altitude, 76, 80
- Shepperton, W., surface geology and altitude, 76
- Shields (North), 259
- Shields (South), 260 ; death-rate from diarrhoea and pulmonary diseases high at, 260 ; drainage, 261 ; water supply, 261
- Shooters Hill, S.E. surface geology and altitude, 78, 79
- Shoreditch, crude and corrected death-rates, 53 ; death-rate from phthisis, 60
- Shortlands, S.E., surface geology and altitude, 76, 79, 80
- Shropshire (South), mountainous region of, 170 ; *see also* Church Stretton
- Sidcup, S.E., surface geology and altitude, 79
- Sidestrand, near Cromer, 111
- Silloth, 201
- Silvertown. E., surface geology and altitude, 75
- Simpson, Sir James, on Shap Wells, 222
- Skegness, 118 ; unsuitable for invalids, 118
- Skerries, 407 ; meteorology, 408
- Skibbereen, 462
- Skin diseases :
 absent at Achill Island and Doo-gort, 522
 benefited (possibly) by Shap Wells, 222
 certain kinds aggravated at Black-pool, 189
 amount of prevalence in Belfast, 555 ; at Carmarthen, 360 ; in Fishguard district, 372 ; at Galway, 506 ; at Glengariff, 467
 uncommon at Aberystwith, 378 ; at Ardglass, 563 ; at Cheltenham, 150 ; at Clacton-on-Sea, 89 ; in Cork and neighbourhood, 451 ; at Leamington (gouty eczema excepted), 158 ; at Malvern, 143 ; at The Mumbles (except eczema), 355 ; in Northumberland, Durham and Yorkshire (except eczema), 272 ; at Pwllheli, 320 ; at St. David's (except eczema), 368 ; at Tramore, 439 ; in Valentia Island, 485 ; at Woburn Sands, 162
- Sligo, 526
- Sligo (County), *see* Dromore West, Easky, Enniscrone, Mullaghmore, Rosses Point, Strandhill
- Small-pox, death-rate in London County, 1899, 57
- Smerwick, 490
- Smith, Dr. Angus, on air and rain, 23 ; on carbonic acid in London air, 25
- Smithfield, surface geology and altitude, 76
- Smoke, evil effect on public health, 27 ; of London, 26, 28 ; prevention of, 27, 28-31 ; sulphuric and carbonic acids most injurious constituents of, 30

- Smoke accumulation and mist; mutual influences of, 32
- Snaresbrook, N.E., surface geology and altitude, 76, 78
- Sodium chloride, a principal ingredient of Shap Wells, 220
- Soils and subsoils of London district, Mr. H. B. Woodward on, 2
- Solva, 365
- Somerleyton (Suffolk), meteorological observations, 85
- Somers Town, surface geology and altitude, 78
- Sore throat (endemic) absent at Carmarthen, 360; at Glengarriff, 467; at Valentia Island, 485
amount of prevalence at Aberystwith, 378; in Fishguard district, 372; at Galway, 506; in Northumberland, Durham and Yorkshire, 272
prevalent at Achill Island and Doo-gort, 522; in Belfast, 555; in Lake District (fairly), 213; at St. David's, 368
rare till 1898 at Cromer, 110
(relaxed) prevalent in Cork and neighbourhood, 451
(ulcerated) amount of prevalence at Glengarriff, 467
- Southall, W., surface geology and altitude, 76, 80
- Southend, 90; hardly suitable for invalids, 90
- Southerndown, water supply, 350
- Southfields, S.W., surface geology and altitude, 76, 78
- Southgate, N., surface geology and altitude, 79
- Southport, 189, 190; Bright's disease (chronic) benefited at, 190; bronchitis (chronic) benefited at, 190; convalescents from acute lung affections and specific fevers benefited at, 190; heart disease benefited at, 190; phthisis (pulmonary tuberculosis) in later stages benefited at, 190
- Southwark, surface geology and altitude, 75
- Southwark and Vauxhall Water Company, 39; source of supply, 39
- Southwold, 94-99; anæmia prevalent among natives, 98; asthma benefited at, 99,—rare at, 99; bronchitis, amount of prevalence at, 98; climate and meteorology, 96, 97; debility benefited at, 99; diarrhoea, amount of prevalence at, 99; diphtheria rare at, 99; drainage and water supply, 97; eczema preva-
- Southwold—*continued*.
lent at, 99; geological formation, 95; kidney diseases uncommon at, 99; malaria unknown at, 99; neuralgia prevalent at, 99; old age frequent at, 99; phthisis often improved from May to October at, 99,—uncommon at, 98; pleurisy rare at, 98; pneumonia, amount of prevalence at, 98; rheumatism common at, 99; rheumatoid arthritis common at, 99; scarlet fever rare at, 99; scrofula absent (almost) at, 98; trees and vegetation, 96; typhoid fever absent (almost) at, 99; unsuitable for patients who have had malaria, and for rheumatic subjects, 99
- Spas, ancient, of London :
Acton Spa, saline, 43
Bagnigge Wells, saline and purgative, 42
Bermoudsey Spa, chalybeate, 43
Beulah Spa, muriated and sulphated waters, 43
Brixton Hill Spring, bromo-ioduretted, 43
Dulwich Spring, sulphuretted and chalybeate, 43
Hampstead Spa, carbonated chalybeate, 42
Islington Spa, chalybeate, 42, 43
Kilburn Spa, 43
Lambeth Wells, saline purgative, 43
"London Spa," 43
New Wells, 43
Sadlers Wells, chalybeate, 42
St. George's Fields Spa, sulphuretted, 43
St. Pancras and St. Chad, wells of, 42
Shadwell Spa, 43
Streatham Springs, aperient waters, 43
- Spiddle, 508
- Spitalfields, surface geology and altitude, 76
- Spittal, 258
- Spring, climate of Glengarriff best in, 465; climate of Northumberland, Durham and Yorkshire during, 248-250; east winds of, protection of Cheltenham against, 149, 151; Hoylake not desirable for chronic bronchitis in winter and early spring, 191
- Springfield Park, Acton, N.W., surface geology and altitude, 76
- Springs, *see* Mineral springs
- Stacpoole-Westropp, Dr. W. H., on Gowlawen Sulphur Well (Lisdoonvarna), 580

- Staffordshire, death-rate highest in Midland Counties, 132
- Staines, W., surface geology and altitude, 76
- Stanford Hill, N., surface geology and altitude, 76, 78
- Stanmore, N.W., surface geology and altitude, 78, 79
- Stanwell, surface geology and altitude, 76
- Stapleton, meteorological tables, 229
- Starch Green, W., surface geology and altitude, 80
- Stephenson, Dr. E. A., notes on Triamore, 438
- Stepney, E., surface geology and altitude, 76, 80
- Stockwell, S.W., surface geology and altitude, 76
- Stoke D'Abernon, S.W., surface geology and altitude, 76, 78
- Stoke Newington, N., as a residence, 70 ; crude and corrected death-rates, 53 ; death-rate from phthisis, 60 ; surface geology and altitude, 78, 80
- Stokes, Dr. William, on Sybil Head, Smerwick, 490
- Stone, *see* Calculus
- Stonebridge Park, surface geology and altitude, 78
- Strand, crude and corrected death-rates, 53 ; death-rate from phthisis, 60
- Strand-on-the-Green, Chiswick, W., surface geology and altitude, 76, 80
- Strandhill, 528
- Strangford, 560
- Stratford, E., surface geology and altitude, 76
- Strawberry Hill, S.W., surface geology and altitude, 76
- Streatham, S., surface geology and altitude, 76, 78
- Streatham Springs, aperient waters, 43
- Strelley-Southwell, sunshine tables, 174
- Stroud Green, N., surface geology and altitude, 78
- Struma, *see* Scrofula
- Studdert and Plunkett (Messrs), analyses (1874) of Lisdoonvarna Springs, 581-585
- Subsoils and soils of London district, Mr. H. B. Woodward on, 2
- Sub-thermal spring at Mallow, 453
- Sudbury, N.W., surface geology and altitude, 78
- Suffolk, surface and geological formation, 82 ; *see also* Aldeburgh, Felixstowe, Lowestoft, Southwold
- Sulphate of sodium, a principal ingredient of the Shearsby Spring, 173
- Sulphated and muriated waters, Beulah Spa, 43
- Sulphide of hydrogen ingredient of Foogha Spa, 499
- Sulphur Spas : Gowlawn Sulphur Well (Lisdoonvarna), 581 ; Dulwich Spa, 43 ; Dunkineely, 533 ; Kinlough, 532 ; Lucan, 416 ; St. George's Fields Spa, 43 ; Twin Sulphur Well (Lisdoonvarna), 584, 585
- Sulphuretted hydrogen in Twin Sulphur Well (Lisdoonvarna), 584 ; variation in strength in Gowlawn Sulphur Well (Lisdoonvarna), 583
- Sulphuric acid and carbonic acid most injurious constituents of smoke, 30
- Summer : Blackpool undesirable in summer months for invalids, 189 ; climate of Cheltenham relaxing in, 149 ; climate of Northumberland, Durham and Yorkshire during, 250-252 ; diarrhoea prevalent in Douglas, Isle of Man, in hot summers, 224 ; Irish health resorts suitable for summer residence, 387 ; Laytown, summer resort for children, 577 ; Lisdoonvarna, health-giving summer and autumn residence, 581 ; phthisis benefited by Ardglass in, 562 ; phthisis (early) may benefit on Yorkshire coast in summer and early autumn, 275 ; temperature of inland stations hotter than that of sea-coast in, 123 ; temperature of Midland Counties not so high as that of London in, 129, 131
- Summer's Town, Tooting, surface geology and altitude, 75, 76, 78
- Sunbury, W., surface geology and altitude, 76
- Sunderland, 261 ; *see also* Roker
- Sundridge Park, S.E., surface geology and altitude, 74, 79, 80
- Sunlight, estimation and registration of, 17 ; intensity, 17
- Sunshine at Colwyn Bay, 307 ; in Durham, 246, 247 ; in Isle of Man, 223 ; at Llandudno, 314 ; in London, 17 ; at Lowestoft, 101 ; in Midland Counties, 125, —less abundant than at sea-coast stations, 125 ; in Northumberland, 246, 247 ; in North Wales, 291-296 ; in South Wales, 340 ; in Yorkshire, 246, 247
- Sunshine tables, Bunhill Row (London), 176 ; Cambridge, 174 ; Cirencester, 175 ; Kew, 176 ; Leicester, 175 ; London, 17, 18 ; Midland Counties, 125, 126 ; Oxford, 174 ; Strelley-Southwell, 174 ; Worksop, 174

- Surbiton, S.W., surface geology and altitude, 76, 78
 Surface configuration of Greater London, 7
 Surgical diseases of childhood benefited at Felixstowe, 94
 Surrey, mortality from all causes, 63; from cancer, 63; from diseases of circulatory system, 64,—of digestive system, 64,—of nervous system, 65,—of respiratory system, 64,—of urinary system, 64; from phthisis 64
 Sussex, mortality from all causes, 63; from cancer, 63; from diseases of circulatory system, 64,—of digestive system, 64,—of nervous system, 65,—of respiratory system, 64,—of urinary system, 64; from phthisis, 64
 Sutton, S., surface geology and altitude, 74, 76, 79, 80
 Sutton, Mr. F., F.C.S., analysis of water supply of Lynn district, 113, 114
 Sutton-on-Sea, 118; unsuitable for invalids, 118
 Swanley, S.E., surface geology and altitude, 74, 79
 Swansea, anæmia and debility, amount of prevalence of, 351; asthma benefited at, 352; bronchitis, pneumonia and pleurisy prevalent at, 352; cancer increasing, 353; causes of death, 353; death-rate from bronchitis, pleurisy, pneumonia, 352,—from cancer, 353,—from phthisis, 351, 352; diarrhoea rare at, 352; diphtheria uncommon at, 353; drainage, 353; hæmoptysis infrequent, 351; health resort no longer, 350; kidney diseases infrequent at, 352; malaria absent, 352; phthisis decreasing at, 351; scarlet fever, amount of prevalence of, 352; scrofula, rare at, 351; skin diseases not common at, 352; tubercular diseases benefited at, 351; typhoid fever decreasing, 352; water supply, 350
 Sybil Head, Smerwick, 490
 Sydenham, S.E., as a residence, 68; metropolitan health resort, 72; surface geology and altitude, 78
 Symons, Mr. G. J., F.R.S., the rainfall of the coast of South Wales, 337
 Syon Park, Isleworth, W., surface geology and altitude, 76
 Syphilis almost unknown in country regions of Lake District, 213
 TABES MESENTERICA, amount of prevalence in North Wales, 299
 Teddington, W., surface geology and altitude, 76
 Temperature, effect on death-rate from diarrhoea at Cardiff, 345; influence on fog of London 35; of Buxton (mean minimum) in winter lower than at any other English station, 166; of Cardiff in four seasons, 340; of Dublin, 390, 391; of Durham, 244,—in spring, 248,—in summer, 250,—in autumn, 252,—in winter, 254; at Killarney, 493; of Midland Counties, 122,—colder than in London in summer, 129, 131,—colder in winter and hotter in summer than on sea-coast, 123; of Northumberland, 244,—in spring, 248,—in summer, 250,—in autumn, 252,—in winter, 254; of sea on coast of Wales, 334; of Valentia Island, 477-480; of North Wales, 291-296; of Yorkshire, 244,—in spring, 248,—in summer, 250,—in autumn, 252,—in winter, 254
 Temperature tables, Midland Counties, 122-124
 Temple Fortune, N.W., surface geology and altitude, 78, 79
 Tenby, anæmia benefited at, 363; anæmia and debility rare at, 362; arthritis rare at, 362; asthma benefited at, 363,—rare at, 362; climate as affected by Gulf Stream, 361; conducive to and suitable for old age, 362, 363; eczema rare at, 362; drainage, 362; hæmoptysis rare at, 362; kidney diseases benefited at, 363,—rare at, 362; mortality returns, 362; neuralgia, amount of prevalence, 362; phthisis prevalent at, 362,—benefited at, 363; pneumonia and bronchitis prevalent at, 362; rainfall, 361; rheumatism rare at, 362; scrofula rare at, 362; tubercular diseases benefited at, 363,—rare at, 362; typhoid fever rare at, 362; water supply, 362
 Thackeray, W. M., on Glengariff, 465
 Thames Ditton, S.W., surface geology and altitude, 76
 Thanet Beds in County of London and Greater London, 79
 Theydon Bois, N.E., surface geology and altitude, 74, 78
 Theydon Gernon, N.E., surface geology and altitude, 74, 78
 Theydon Mount, N.E., surface geology and altitude, 74, 78, 79
 Thomas, Dr. A., notes on Aberystwith, 377
 Thornton Heath, Croydon, S., surface geology and altitude, 76
 Throat diseases (chronic catarrhal)

Throat diseases—*continued*.

benefited by Queenstown (Co. Cork), 458

Throat (sore), *see* Sore throat

Thyroid (enlarged) prevalent around Windermere, 213

Tollington Park, N., surface geology and altitude, 78

Tonsillitis prevalent at Glengarriff, 467

Tonsils (enlarged) benefited at Malvern, 143; rare at Malvern, 143

Tooting, S., surface geology and altitude, 76, 78

Tottenham, surface geology and altitude, 76, 78

Totteridge, N.W., surface geology and altitude, 79

Towyn, exposed position of, 325

Trachoma prevalent in County Cork, 451

Tramore, 438; anæmia absent at, 439,—benefited at, 439; debility benefited at, 439; diphtheria absent at, 439; drainage, 439; influenza, amount of prevalence at, 439; kidney diseases rare at, 439; phthisis rare at, 439; rheumatism rare at, 439; skin diseases rare at, 439; water supply, 439

Trefriw, anæmia, debility and chlorosis benefited at, 328; ferruginous springs of, 327; water supply, 327

Trimingham (near Cromer), 111

Tuberculosis (pulmonary), *see* Phthisis

Tubercular diseases, other than phthisis pulmonalis:

benefited at Aberystwith, 377; at Cromer, 110; at Felixstowe, 94; at Malvern, 143; at The Mumbles, 355; at Swansea, 351; at Tenby, 363

amount of prevalence at Cardiff, 341; at Carmarthen, 359; at Crickieth, 321; at Galway, 505; in Lake District, 211; at Pwllheli, 320; at Nevin, 319; in North Wales, 299

prevalent in Belfast, 555; in Cork and neighbourhood, 450

uncommon at Aberystwith, 377; at Achill Island and Doogort, 522; at Ardglass, 562; at Barmouth, 324; at Buncrana, 537; at Cheltenham, 150; at Clacton-on-Sea, 88; at Cromer, 110; at Felixstowe, 93; in Fishguard district, 371; at Leamington, 158; at Malvern, 143; at Minchinhampton, 154; at The Mumbles, 355; at St. David's, 368; at Swansea, 351; at Tenby, 362; at Woburn Sands, 162

Tubercular diseases—*continued*.

See also Glands (tuberculous diseases of), and Joints (tuberculous diseases of)

Tufnell Park, N., surface geology and altitude, 78

Tulse Hill, S., surface geology and altitude, 78

Tunbridge Wells, analysis of chalybeate water compared with that of Flitwick water, 172

Turnham Green, W., surface geology and altitude, 80

Tweedmouth, 258

Twickenham, surface geology and altitude, 76

Twin Sulphur Well, Lisdoonvarna, analysis of, 584, 585

Twyford, N.W., surface geology and altitude, 78

Tynemouth, 259

Typhoid fever:

almost unknown at Barmouth, 324; at Dovercourt, 90; in Lake District (except in towns), 213; at Southwold, 99; at Tenby, 362

death-rate in London County, 1899, 58; in Midland Counties, 134

decreasing at Swansea, 352

amount of prevalence at Cardiff, 344; at Galway, 506; at Lowestoft, 104; at The Mumbles, 355; in Northumberland, Durham and Yorkshire, 272; at Seaham, 261; in North Wales, 299

prevalent in Belfast, 555; at Carmarthen, 360; in Cork and neighbourhood, 451; in Douglas (Isle of Man), 224; in Dublin (City), 389

rare at Aberystwith, 378; at Achill Island and Doogort, 522; at Ardglass, 563; at Beaumaris, 317; at Buncrana, 537; at Cheltenham, 150; at Clacton-on-Sea, 89; at Colwyn Bay, 308; at Crickieth, 322; at Cromer, 110; at Felixstowe, 93; in Fishguard district, 372; at Leamington (very), 158; at Portrush, 546; at Pwllheli, 320; at St. David's, 368; in Valentia Island, 485; at Woburn Sands, 162

Typhus fever, persistence of, in the Arran Islands, 504; in Cork and neighbourhood, 451

death-rate in London County, 1899, insignificant, 57

- Tyrer, Mr. R., F.R.Met.Soc., on the meteorology of Cheltenham, 146
- UPTON, E., surface geology and altitude 76
- Upton Park, E., surface geology and altitude, 76
- Urinary system, diseases of, mortality from, in England and Wales, 64; in Essex, 64; in Kent, 64; in London County, 64; in Middlesex, 64; in Surrey, 64; in Sussex, 64
- Ushaw (Ushaw Moor), 262; meteorology, 262; meteorological tables, 256, 285
- Uxbridge, W., surface geology and altitude, 76
- VALE OF CLWYD suitable for treatment of phthisis, 328; rainfall, 328
- Vale of Ovoca (Arklow), 431
- Valentia Island, 474-487; albuminuria (chronic) rare, 485; anæmia and debility uncommon, 485; asthma rare, 485; bronchitis and catarrh rare, 485; calculus and gravel unknown, 485; diarrhœa uncommon, 485; diphtheria rare, 485; drainage, 482; geology, 475; hay asthma benefited by, 486; malarial affections absent, 485; measles, fatal epidemic of, 486; meteorological table, 483; meteorology, 477; neuralgia prevalent, 485; old age frequent, 486; phthisis very rare, 485,—probably benefited by, 486; pleurisy rare, 485; pneumonia rare, 485; rainfall, 480; renal dropsy (acute) rare, 485; rheumatism somewhat prevalent, 485; scarlet fever, amount of prevalence, 485; scrofula rare, 485; skin diseases rare, 485; sore throat (endemic) absent, 485; temperature, 477-480; typhoid fever rare, 485; vegetation, 476; water supply, 484; winds, force and amount, 482
- Valley brick-earth or loam, *see* Brick-earth
- Valley gravel and sand, *see* Gravel
- Vauxhall, surface geology and altitude, 76
- Vegetation of Durham, 237; of Lake District, 208; of Northumberland, 237; of Southwold, 96; of Valentia Island, 476; of Woburn Sands, 160; of Yorkshire, 237
- Ventry, 490
- Vertical production of "high fog" in London, 34
- Victoria Park, N.E., surface geology and altitude, 76
- WADDON, S., surface geology and altitude, 74, 79
- Wakeling, Mr. T. G., notes on Clacton-on-Sea, 87
- Walbrook, surface geology and altitude, 75, 76
- Wales (mortality), *see* England and Wales (mortality); temperature of sea surface, 334
- Wales (North), climate during winter, 288, 295, 296
- diphtheria, amount of prevalence, 299, 300
- effect in winter of coast aspect, 288, 296
- geology, 288
- health resorts (inland), *see* Bettws-y-Coed, Llangollen, Trefriw, Vale of Clwyd; (seaside), *see* Abergele, Abersoch, Anglesey, Barmouth, Beaumaris, Borth, Bull Bay, Cemmaes Bay, Colwyn Bay, Criccieth, Deganwy, Harlech, Holy Island, Llanbedrog, Llandudno, Llandulas, Llanfairfechan, Llyn Peninsula, Menai Straits, Nevin, Penmaenmawr, Pensarn, Prestatyn, Pwllheli, Portmadoc, Red Wharf Bay, Rhoscollyn, Rhosnegir, Rhyl, Towyn
- humidity, 290
- malaria, disappearance of, 297
- meteorological tables, *see* Colwyn Bay, Llandudno, Rhyl
- meteorology, 289
- physical configuration, 286-288
- phthisis, amount of prevalence, 297-299
- rainfall, 289
- scarlet fever, amount of prevalence, 299
- sunshine, 291-296
- tabes mesenterica and other tubercular affections, amount of prevalence, 299
- temperature, 291-296
- typhoid fever, amount of prevalence, 299
- winter resorts, 289
- Wales (South), character and physical configuration, 229-331
- chief causes of death, 380
- climate as affected by ocean currents, 330, 333-335; in relation to prevalence of disease, 340, 380; *see also* Cardiff; tends to prolong life of the aged, 380
- clouds, 340
- geology, 331-333

Wales (South)—*continued*.

- health resorts, *see* Aberaeron, Aberporth, Aberystwith, Bracelet Bay, Broadhaven, Carmarthen, Caswell Bay, Ferryside, Fishguard, Goodwick, Langland Bay, Mumbles, Newport, New Quay, Oxwich, Penarth, Peninsula of Gower, Port Eynon, Porthcawl, Solva, Southerndown, St. Bride's Bay, St. David's, Swansea, Tenby
- lung diseases prevalent, 379
- meteorological tables, *see* Aberystwith, Cardiff, Carmarthen, St. Ann's Head, St. David's
- meteorology, 335-337
- phthisis prevalent in, 380
- rainfall on coast, 337-339
- rheumatism prevalent, 379
- sunshine, 340
- winds, 340
- Walford, Dr. E., notes on Cardiff, 341
- Walham Green, W., surface geology and altitude, 76, 80
- Walker, Mr. A. O., notes on Colwyn Bay, 305
- Wallington, S.W., surface geology and altitude, 74, 79
- Waltham Abbey, N.E., surface geology and altitude, 76
- Waltham Cross, N., surface geology and altitude, 77
- Walthamstow, N.E., surface geology and altitude, 77, 78
- Walton-on-the-Naze, 89
- Walton-on-Thames, S.W., surface geology and altitude 77
- Walworth, S., surface geology and altitude, 77
- Wandsworth, crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 77, 78, 80; upper districts favourable to rheumatism, 71,—healthy and bracing, 69
- Wanstead, N.E., surface geology and altitude, 77, 78
- Warrenpoint, 571; rainfall, 571
- Warwickshire, death-rate one of highest in Midland Counties, 132
- Washhouses, *see* Baths
- Water Companies of London (Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, West Middlesex), 38, 39; purchase attempted by London County Council, 40; source of supply, 39
- Water famine, danger of, in London district, 41, 42

- Water supply at Aberdovey, 326; at Aberystwith, 379; at Achill Island and Doogort, 523; in villages of Anglesey, 317; at Ard-glass, 564; at Ascot, 164; at Bamburgh, 259; at Barmouth, 324; at Beaumaris, 317; at Belfast, 553; at Buncrana, 537; at Cardiff (analysis), 346-348; at Carmarthen, 360; at Clacton-on-Sea, 88; at Colwyn Bay, 307; at Criccieth, 322; at Cromer, 109, 110; at Darlington, 263; at Dovercourt, 90; at Drogheda, 575; of Dublin, 396-403; at Felixstowe, 92; at Fishguard, 373; at Galway, 507; at Grey-stones, 424; at Harlech, 323; at Hornsea, 268; in Isle of Man, 224; at Kendal, 220; at Kilmore Quay, 435; at Kingstown, 413; in Lake District, 211; at Laytown, 577; at Leamington, 156; at Llandudno, 312; at Llandulas, 304; at Llangollen, 326; of London, 37-40,—danger of water famine, 41, 42,—dangers connected with, 41,—defects of, 41,—depletion of rivers due to, 41,—impurity possible, 41,—infection possible, 41; at Lowestoft, 101; at Malahide, 407; at Malvern, 142; of Marshland (Lynn district), 113, 114,—impregnated with salt, 113,—impregnation with salt possible cause of absence of calculus, 115, 117; at The Mumbles, 355; at Nevin, 319; at Penmaenmawr, 315; at Portrush, 544, 545; at Prestatyn, 301; at Rhyl, 302; at St. David's, 369; at Saltburn, 265; at Scarborough, 267; at Seaham, 261; at Shields (South), 261; at Southerndown, 350; at Southwold, 97; at Swansea, 351; at Tenby, 362; at Tramore, 439; at Trefriw, 327; at Valentia Island, 484; at Whitby, 266; of Windermere district, 218; at Woburn Sands 161; at Great Yarmouth, 108; of Yorkshire, 269
- purity of water supply does not diminish death-rate from infantile diarrhoea in Glasgow, 58
- Waterford (City), 436-438; rainfall, 438
- Waterford (County), *see* Ardmore, Bonmahon, Cappoquin, Dungarvan, Dunmore (East), Lismore, Tramore, Youghal

- Waterlow Park, surface geology and altitude, 78, 79
 Waterville, 473
 Wathen, Dr. J. H., notes on Fishguard district, 371
 Wealdstone, Harrow, N.W., surface geology and altitude, 78
 Welling, Bexley, S.E., surface geology and altitude, 79
 Wells-next-the-Sea, 111; bronchitis (chronic) not suited by climate, 112; phthisis benefited in summer, 112
 Wembley Park, N.W., surface geology and altitude, 78
 West Drayton, W., surface geology and altitude, 77, 80
 West End, Hampstead, N.W., surface geology and altitude, 78
 West Kirby, 191; chronic bronchial, kidney, and lung diseases benefited at, 191
 West Malvern, *see* Malvern (West)
 West Middlesex Waterworks Company, 39; source of supply, 39
 Westbourne Park, W., surface geology and altitude, 78
 Westcombe Park, S.E., surface geology and altitude, 74, 79, 80
 Westminster, crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 75, 77
 Westmorland, death-rate, 214, 215; rainfall, 206; rainfall tables, *see* Appleby, Elterwater, Shap, Windermere
 Westow Hill, Norwood, S.E., surface geology and altitude, 78
 Westport, 515
 Wexford (County), *see* Blackwater, Courtown Harbour, Curracloe, Kilmore Quay, Rosslare
 Wexford (Town), 433
 Weybridge (pine districts), bronchitis benefited at, 72; kidney disease benefited at, 72; pulmonary catarrh benefited at, 72
 Whetstone, N., surface geology and altitude, 74, 79
 Whitaker, Dr. H., notes on Belfast, 553-555
 Whitby, 259, 265, 266; drainage, 266; water supply, 266
 Whitechapel, crude and corrected death-rates, 53; death-rate from phthisis, 60; surface geology and altitude, 77
 Whitegate and Agghada, 459
 Whitehead, 551
 Whitley, 259
 Whooping-cough, death-rate in London County, 1899, 57; in Midland Counties, 134
 Wickham Court, S.E., surface geology and altitude, 74, 79
 Wickham (East), surface geology and altitude, 80
 Wickham (West), S.E., surface geology and altitude, 79
 Wicklow (County), 418; *see also* Bray, Delgany, Enniskerry, Greystones, National Hospital for Consumption for Ireland
 Wicklow (Town), 427, 428
 Willesden, N.W., surface geology and altitude, 78
 Williams, Dr. W. H., notes on St. David's, 368
 Williamstown, 409
 Wimbledon, S.W., as a residence, 68; contra-indicated in cases of rheumatism, 72; surface geology and altitude, 77, 78
 Winchmore Hill, N., surface geology and altitude, 79
 Wind-exposure of Malvern, 139
 Windermere (Lake, district of), 218; *see also* Ambleside, Bowness, Windermere (Town); carbuncles not uncommon in, 213; convalescents benefited in, 217; thyroid (enlarged) frequent in, 213
 Windermere (Town), 218; drainage and water supply, 218; rainfall table, 207
 Winds prevalent, in Durham, 245, 246,—in spring, 249,—in summer, 252,—in autumn, 253,—in winter, 255; at Lowestoft, 101; in Northumberland, 245, 246,—in spring, 249,—in summer, 252,—in autumn, 253,—in winter, 255; at Valentia Island, force and amount, 482; in South Wales, 340; in Yorkshire, 245, 346,—in spring, 249,—in summer, 252,—in autumn, 253,—in winter, 255; *see also* East Winds
 Winter, climate of Northumberland, Durham and Yorkshire during, 254, 255; of North Wales during, 288, 295, 296; Hoylelake not desirable for chronic bronchitis in winter and early spring, 191; Irish health resorts suitable for, 387; Mallaranny (Co. Mayo), as health resort in, 518
 Winter resorts, advantages of Beaumaris, 316; of Colwyn Bay, 304-306; of Gower Peninsula, 357; in North Wales, 289; Llanfairfechan, 315
 Winter temperature of Buxton (mean minimum) lower than at any other

Winter temperature—*continued*.

English station, 166 ; of inland stations colder than on sea-coast, 123

Withernsea, 268

Woburn Sands, 159-163 ; anæmia rare at, 162 ; asthma benefited at, 162, — rare at, 162 ; bronchitis benefited at, 162, — rare at, 162 ; calculus and gravel rare at, 162 ; debility rare at, 162 ; diarrhoea, amount of prevalence, 162 ; diphtheria, amount of prevalence, 162 ; drainage, 161 ; dropsy (renal acute) rare at, 162 ; geological formation and soil, 160 ; heart disease benefited at, 162 ; malaria absent at, 162 ; meteorology and climate, 160, 161 ; neuralgia rare at, 162 ; phthisis benefited at, 162, — rare at, 162 ; pleurisy rare at, 162 ; pneumonia rare at, 162 ; rheumatic fever rare at, 162, — benefited at, 162 ; rheumatism (muscular), amount of prevalence at, 162 ; rheumatoid arthritis rare at, 162 ; scarlet fever, amount of prevalence, 162 ; scrofula rare at, 162 ; skin diseases rare at, 162 ; trees and vegetation, 160 ; tuberculous diseases rare at, 162 ; typhoid fever rare at, 162 ; water supply, 161

Woking (pine districts), bronchitis benefited at, 72 ; kidney disease benefited at, 72 ; pulmonary catarrh benefited at, 72

Wood Green, N., surface geology and altitude, 78

Woodford, N.E., surface geology and altitude, 78, 79

Woodgrange Park, Ilford, E., surface geology and altitude, 77

Woodside Park, Finchley, N., surface geology and altitude, 74

Woodward, Mr. H. B., F.R.S., on soils and subsoils of London district, 2

Woolwich, S.E., crude and corrected

Woolwich, S.E.—*continued*.

death-rates, 53 ; death-rate from phthisis, 60 ; surface geology and altitude, 74, 79, 80

Woolwich (North), E., surface geology and altitude, 75

Woolwich and Reading Beds in County of London and Greater London, 79

Worcester Park, S.W., surface geology and altitude, 78

Workop, sunshine tables, 174

Wormwood Scrubs, N.W., surface geology and altitude, 78

Wright-Grant, Dr. J., notes on Woburn Sands, 162

Wroth, Mr. W., on ancient London spas, 42

Wynne, Archdeacon, on amount of cloud at Killarney, 494

YARMOUTH (Great), 105-109 ; drainage, 108 ; infectious diseases, official statistics not obtainable, 108 ; isolation hospitals, 108 ; meteorology, 106-108 ; water supply, 108

Yeading Hayes, N.W., surface geology and altitude, 80

Yiewsley, W., surface geology and altitude, 77, 80

Yorkshire, coast resorts, phthisis (early) may benefit at, in summer or early autumn, 275 ; drainage, 269 ; drainage (natural), 236 ; geology, 233 ; meteorological tables, *see* Aysgarth, Bradford, Halifax, Hull, Rounton, Scarborough ; minerals, 234 ; physical features, 232 ; resorts in, *see* Bridlington, Filey, Hornsea, Redcar, Robin Hood's Bay, Saltburn Scarborough, Whitby, Withernsea ; soils, 235 ; water supply, 269 : *see also* Northumberland, Durham and Yorkshire

Young (The), *see* Adolescents

Youghal, 441-444

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